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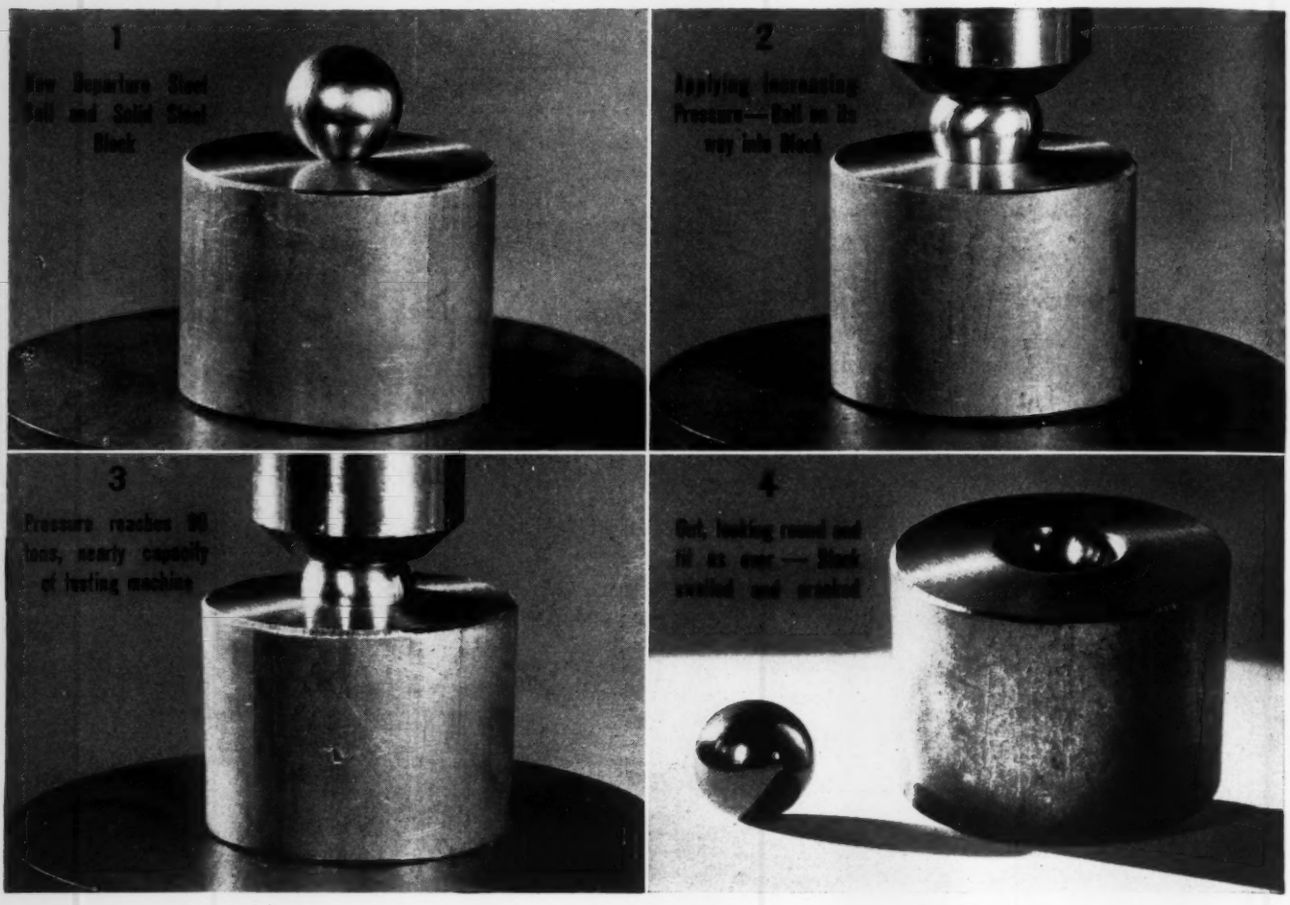
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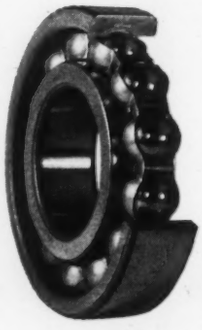

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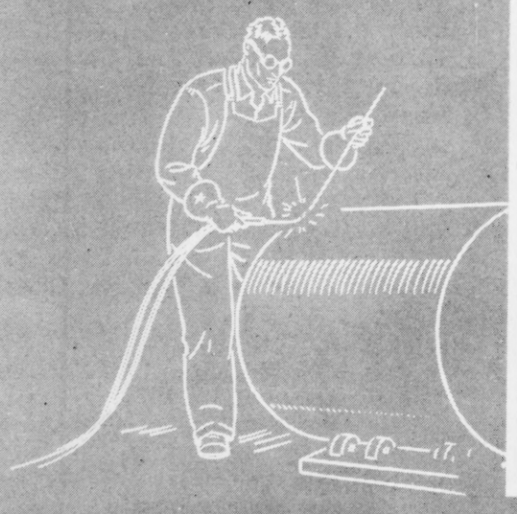

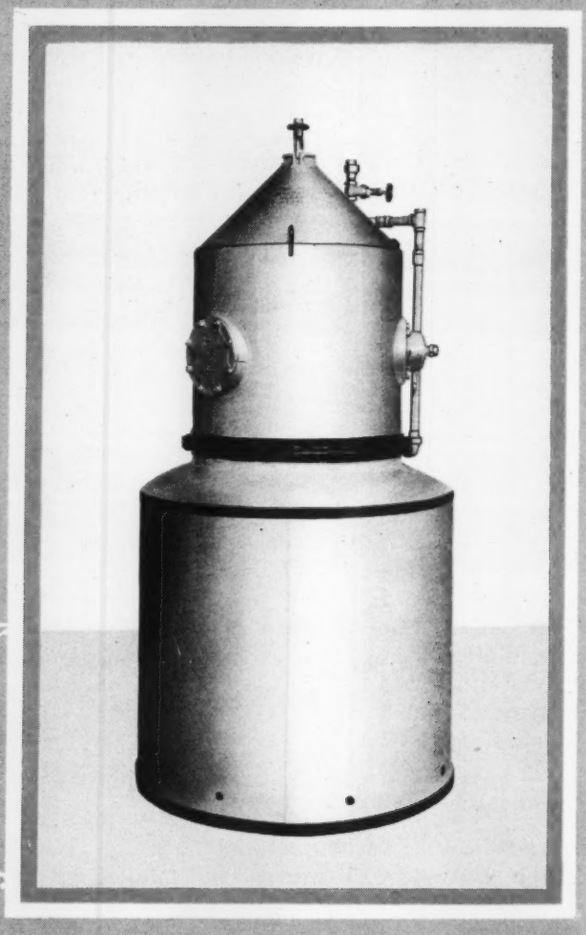

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Topics . . .

PREFERRED numbers as an aid in selecting standard sizes are being widely adopted by designers in all fields. The latest development in this activity is the publication by American Standards association of a revised edition of its preferred numbers recommendations first circulated for criticism and comment in 1934. Revisions resulting from these comments are included in the present edition. This development permits an answer to the question "How many sizes of a certain item are necessary to cover adequately the entire range of sizes required; what should be the step-up in these sizes?" The term "sizes" includes not only length, but also area, volume, weight, capacity, rating, etc.

♦ ♦ ♦

The incorrect inclusion of many varied materials under the name of "cast iron", an all too frequent happening in the past, can no longer be attributed to the lack of an adequate definition. Following the preparation of such a definition by the committee on cast iron of American Foundrymen's association and British Cast Iron Research association, the National Bureau of Standards defines the material as: "Cast iron is a cast alloy of iron and carbon, with or without other elements, in which the carbon content exceeds the maximum limit of solid solubility, as determined at any temperature (which in plain cast iron is 1.7 per cent) and, hence, contains eutectic carbide or graphite as a structural feature. It is not usefully forgeable at any temperature."

♦ ♦ ♦

One of the more significant developments in the production of cast iron is the perfection of the "concrete" mold method. Castings made by this method require less machining as they adhere closely to pattern contours and have unusually smooth surfaces. Simpler patterns are possible, and no flasks are used in making the castings.

♦ ♦ ♦

When designing chain drives, the engineer should not overlook the fact that when the drive operates continuously it should be taken into account as an overload. Other facts which result in unusually severe service are speed-up drives where the driven shaft revolves at the exceptionally high speed and so carries the smaller sprocket; also, extremely high reduction ratios which require a sprocket smaller than the recommended minimum. Extra chain and sprocket capacity under unusual conditions will pay dividends of far more value than the extra cost.

♦ ♦ ♦

A diesel engine which is said to run on anything that will burn has been developed by Rudolph Fawlikowski of Germany. The fuels which can be utilized by this engine include hard coal, soft coal, lignite, peat, fruit or potato peelings, sawdust, leaves, corn stalks and many others. It is interesting to note in this connection that Diesel's first idea in relation to his engine was that it would burn coal dust as the fuel.

♦ ♦ ♦

Another interesting development in motors is the completion in Canada of a kinetic motor which derives its power from pressure and expansion, accomplishing the action without reciprocating members. This device can reverse with full torque without any added mechanism. It is simple, light in weight, and requires very little expenditure for maintenance.

♦ ♦ ♦

The largest propellers ever cast in a single unit are those which drive the QUEEN MARY. There are four of them of manganese bronze, weighing 35 tons each.

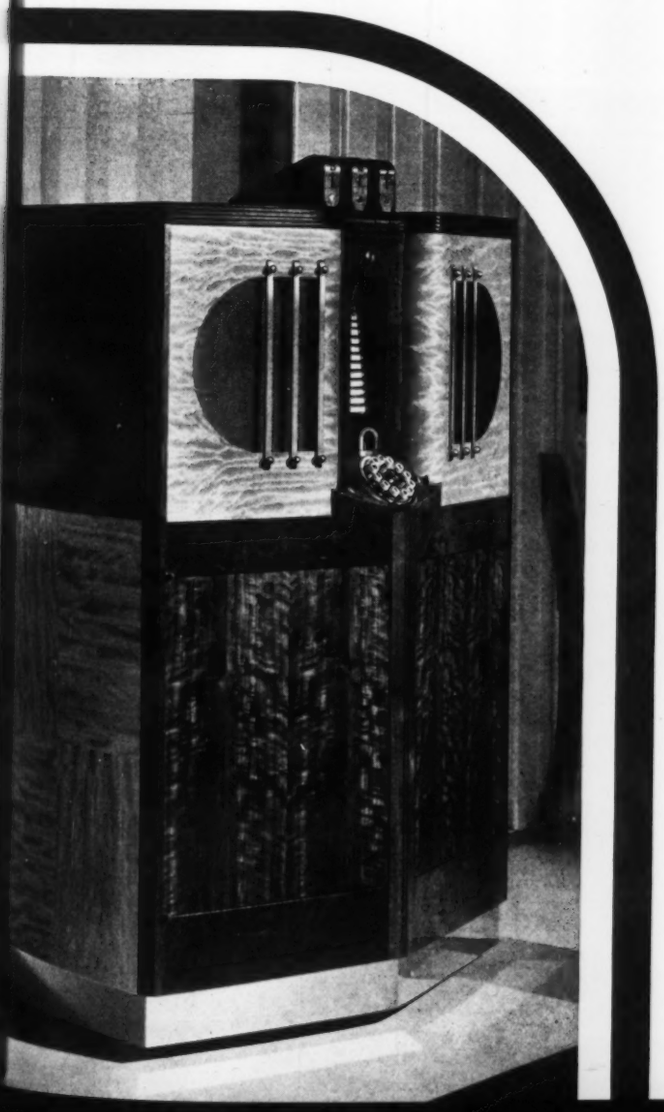
MACHINE DESIGN

Its Own Salesman—

The Coin Machine

By Everett B. Eckland

Industrial Engineer,
Mills Novelty Co.



ESTABLISHED practices are a vital necessity in design, but the designer must be careful lest the established practice becomes a permanent practice. This might seriously handicap customer acceptance of his machine when constructive change would be beneficial. An example of this established practice can be found in the design of automatic phonographs where for years the record-changing mechanism has been placed at the top of the machine so that the user could see it. This was an excellent procedure when this type of phonograph was a novelty, as everyone was interested in how the unit worked. But today the novelty has worn off, and the user is merely interested in the music reproduced by the machine.

In the design of the new Do Re Mi automatic phonograph of Mills Novelty Co., the record changing mechanism has been completely removed from the sight of the user for a number of very excellent reasons. The mechanism has been mounted at the bottom of the machine to place the greatest weight at the base and thus

Fig. 1 — Automatic phonograph is designed to create user acceptance that leads to its use

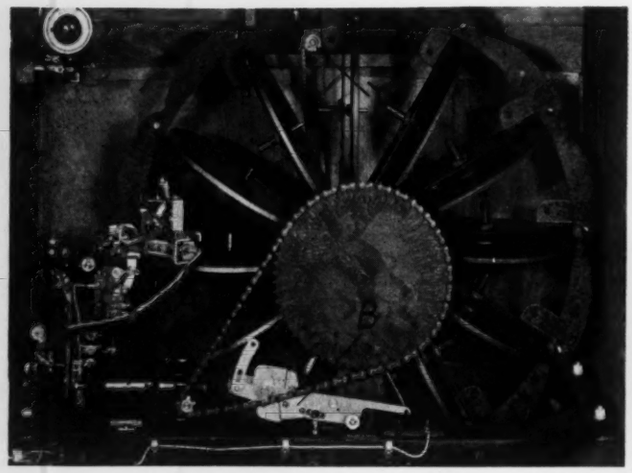
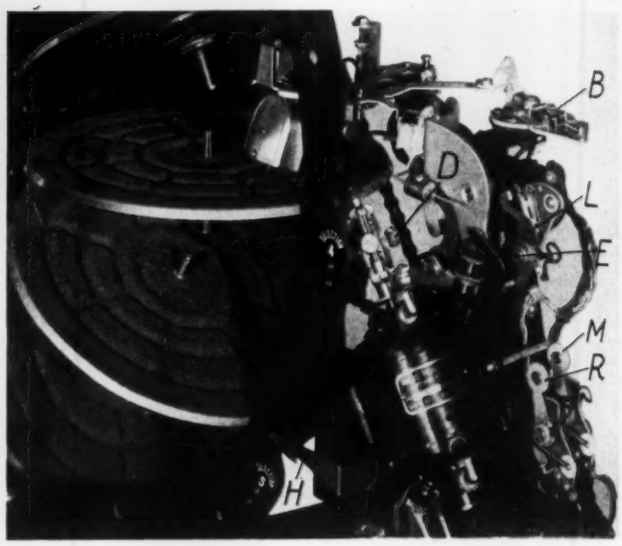


Fig. 2—Wheel, rotating on its shaft, carries records into playing position without danger of damage

Fig. 3—Disk driving motor controls the movement of records through the rubber wheel on its shaft



minimize the danger of tipping. Also, such an arrangement allows the loud speakers to be located at the top of the machine. In this location the music is broadcast through the room at a height over the many obstructions such as tables, chairs, etc., and there is far less distortion of the music throughout the room. Thus maximum tone clarity and volume is obtained, while the arrangement still permits easy accessibility of operating controls.

Another advantage of the relocation of driving equipment is that this arrangement permits the amplifying unit to be mounted at the top so that the heat generated by this unit will pass out of the back of the machine near the top and will not heat the records, causing them to warp.

In a machine of this type attractive appearance is a vital necessity. To insure user acceptance, the unit must create attention, and this attention must lead to the use of a machine. It is a coin-operated unit, and the income of the purchaser of the machine depends upon the number of customers attracted to the equipment.

Utilizes Waste Space

The first step in the redesign for appearance was the utilization of waste space. In previous models the interior mechanism did not require all of the room inside of the cabinet, but the cabinet was left square and the interior space left empty. In the model shown in *Fig.* 1, the face of the machine has been angled toward the sides, eliminating the waste space on the inside and making the machine appear a great deal smaller. To increase the impression of smallness, height has been added to the machine.

Sloping panels in the front gave a further design advantage in that they enabled the use of dual speakers. These speakers not only aid in the more perfect dispersion of the music, but they also enhance the appearance. The line of the front where it joins the record listing and the selector panels has been curved to give a pleasing effect. This curve is essential to proper balance, while it draws the eye to the center of interest at the program. All of these steps make possible the location of coin chute openings at the top, out of the way, tilting of the record listing card at an angle for greatest legibility, and placing the selector mechanism at a 45-degree angle for maximum visibility and usefulness.

Stainless Steel Employed

As a final step in the appearance design, stainless steel and special woods were employed to give the machine the necessary "flash". The cabinet is made of golden Avodire wood, highly figured and brilliant, a rare imported wood from Africa. This wood is supported by mottled walnut, also highly figured, offering a striking contrast. The whole cabinet is accented with chromium trim and its mechanical features. Grill cloths are protected by chrome bar grating.

While this effort toward making the instrument more practical and more attractive is extremely important, of even more importance is the development of mechanisms that will provide the automatic action with the least possible trouble. Mechanical parts of the machine being discussed can be divided into several main sections. These are, the devices for bringing the record to be played into position; coin receiving and inspecting devices with the necessary contacts for starting the machine; mechanisms for bringing the needle to the record, returning it to the starting position and stopping the action, the motor and associated mech-

anisms for turning the disk, and the selector mechanisms by which any of the twelve records in the machine can be played at will.

It was necessary in the original design of this machine to determine the principle on which the unit as a whole would work before designing any parts, as each of the individual sections depends for its means of action upon the design of the other sections. In order to preserve the records for the greatest possible service, it was decided to arrange the machine so that shifting of the records and relative movement between them would be at an absolute minimum. To accomplish this, a ferris wheel type of record holder was adopted. Once placed on these holders, as shown in *Fig.* 2, the records are not disturbed except when they are played, at which time they are rotated on the plates. When a record is changed the wheel merely rotates on its shaft to the proper position, carrying all of the records with it. Movement of the wheel is by means of the geared motor at *A* in *Fig.* 2, operating through roller chain to the ferris wheel shaft. Correct tension on the chain is maintained by pressure of the automatic timer arm at *B*.

New Record Mechanism Required

Adoption of this basic principle for record changing made it impossible to utilize the usual method of rotating the disks, that is, bringing them down onto a plate in permanent relation to the rest of the machine which is rotated by a fixed motor. In this machine the disks are stopped, ready for playing, at a fixed point in the cycle of the wheel. At this point the disk driving motor, shown in *Fig.* 3, is turned about its shaft through linkages until a rubber wheel on the end of the motor shaft, *C* in *Fig.* 3, contacts the plate on which the record is carried. Operation of the motor turns the record, the speed of which is controlled by the spring-held governor weights at *D*, tension of which is set by the adjusting screw *E*.

Operation of this disk motor and its movements, as well as operation of the sound pick-up arm, *Fig.* 5, is controlled through a series of levers and linkages, which in turn receive their actuation from the ferris wheel cam roller, *H* in *Fig.* 3. Movement of this roller is controlled by the cam which forms the outer rim of the ferris wheel and as the cam is turned by the record changing motor it can be seen that it is this motor that governs all movements.

Employs Electrical Controls

Mechanical movements have been abandoned wherever possible in this machine, and electrical controls substituted. The entire action starts with the closing of a switch by the mechanical force of the coin. As a nickel, a dime, or a quarter will start the action, the latter two repeating the action twice or five times, there are three switches which can be operated at the coin chute. Closing of one of these switches energizes one of the trip magnets at *K* in *Fig.* 4. The trip magnet operates the ratchet wheel lever so that the segment on this lever will engage and turn the ratchet wheel clockwise one position. When the stud on the back side of the ratchet wheel moves from the upper carbon arm, this allows the arm to drop on to the lower carbon, thereby starting the instrument. There are also three other switches which operate the changer motor at different points in the cycle. This motor, shown in *Fig.* 2, is started by the switch at *P* in *Fig.* 3 which in turn is energized by the carbon arms shown in *Fig.* 4.

With the changer motor operating through switch *L*, *Fig.* 3, the running switch, the ferris wheel turns to position the record disk for playing. When the ferris wheel cam roller, *H* in *Fig.* 3, is positioned as shown, the changer motor running switch is opened through linkages, thereby stopping this motor. At this time the disk motor has been lowered to engage the record disk as related. It is operating, and the

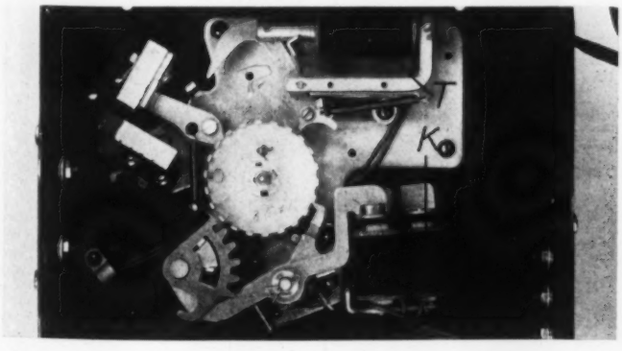


Fig. 4—*This ratchet wheel lever operates the phonograph the number of times required by size of coin*

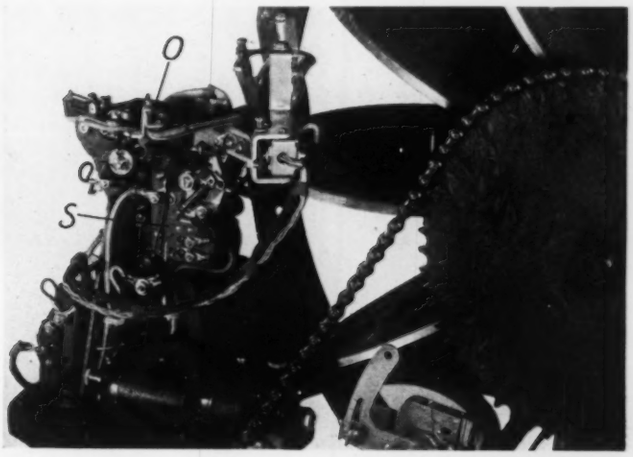


Fig. 5—*Rotation of the record wheel raises the pick-up arm through linkages and disconnects the sound*

rubber wheel is turning the record disk. The pick-up arm has been lowered by the linkages so that the needle in the pick-up starts in the groove on the record. The amplifier has been cut out of the circuit during record changing so that no mechanical noise will be broadcast, but when the needle enters the groove of the record, levers close the cut-off switch, *M* in *Fig.* 3, thus permitting the music of the record to be picked up by the loud speakers.

When the record has finished playing, the needle follows the eccentric groove of the record so that the cut-off ratchet pawl, *O* in *Fig.* 5, operates the changer motor starting switch *P*, which again starts the changer motor. Rotation of the wheel through the cam and roller *H* raises the pick-up arm through linkages. The high speed control switch, *R* in *Fig.* 3, now operates the changer motor. Linkages cut off the amplifier, eliminating the possibility of any sound being transmitted to the speaker, and a further rotation brings switch *P* into action for the running of the changer motor.

When the pick-up arm is raised, the fiber roll on the pick-up arm bracket engages the cut-off switch, *S* in *Fig.* 5, now operates the cut-off magnet, *T* in *Fig.* 4, turning the ratchet wheel counterclockwise so that the stud on the back side of the ratchet wheel will engage the upper carbon arm and raise the upper carbon from the lower carbon, breaking the circuit and stopping the instrument. This completes one cycle of play.

Segment Continues Operation

If any additional nickels have been placed in the coin slot during this cycle, they immediately start a new cycle. The new cycle cannot take effect until after the carbon arm has been returned to its original position, but will occur as soon as this is accomplished. If the original coin was a dime or a quarter, the segment which originally started the machine is still in contact with the ratchet wheel at this point, and the next tooth of this segment immediately restarts the action, repeating the cycle until the entire segment has operated.

There are many other points of interest in this machine such as the interval operating mechanism shown in *Fig.* 2 which starts the unit and plays a record at previously determined intervals so that a minimum period between the playing of records is maintained, and the radio control which permits actuation by means of a movable sending set mounted on rollers and located at any other point in the room, which cannot be covered in an article of this length. However, there are two other mechanisms of vital importance in operation of the machine. These are the selector and coin mechanism.

May Preselect Records

With the multiple selector mechanism it is possible for a patron to preselect one or a number of the records, and they will be played as selected. Order of playing will be in numerical rotation from the last previous record played, but records in between those chosen will not be played.

Operation of this selector mechanism is based on the principle of restraining the ferris wheel cam roller, *H* in *Fig.* 3, so that it will not follow the contour of the cam until the selected record is in position. As the record-changer motor continues to turn the ferris wheel until the motions started by the cam roller take place, this motor will continue to turn until the proper record is in place.

To understand the operation of this selector mechanism it might be best to follow the action when no selection has been made. When the changer motor, operating after playing a record, turns the ferris wheel, the cam roller is forced up the rise of the cam and is caught in the notch of the selector magnet hook arm, *Fig.* 8, where it remains when the machine is stopped. The selector mechanism of *Fig.* 7 is connected by chain, *Y* in *Fig.* 2, to a sprocket on the ferris wheel shaft. When this shaft again starts, the selector mechanism is rotated. At a predetermined point on the cycle, contacts in the selector disk assembly, *Fig.* 6, will energize the

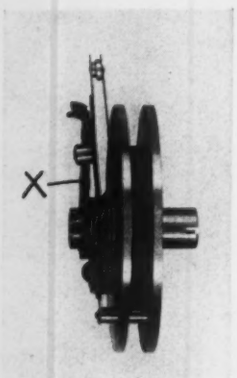


Fig. 6—Contacts in this selector disk assembly energize the selector magnet

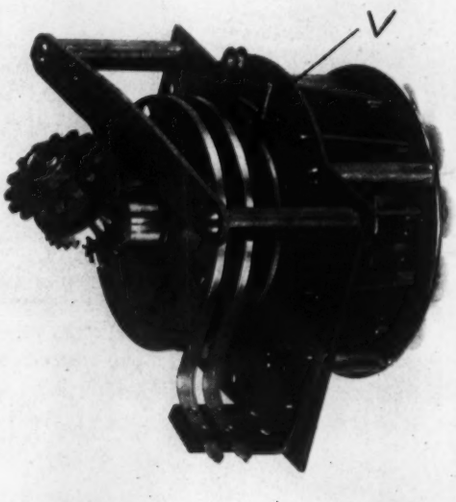


Fig. 7—The selector magnet, in conjunction with this mechanism, raises the hook arm and permits operation

selector magnet, draw up the hook arm, and allow the roller to follow the cam contour and bring about the rest of the cycle.

If one of the selector buttons shown in *Fig.* 7 and also in *Fig.* 1, are depressed, the pins on the ends of this button, *V* in *Fig.* 6, will hold the contacts open and thus hold the cam roller. The contacts will be held open until release lever *X* in *Fig.* 6, turning in direct relation with the ferris wheel, pushes the depressed button out. This allows the contact to close, and the hook to be raised, thus permitting the next record on the ferris wheel to be played. This record is the one that corresponds with the number of the button depressed on the selector dial. Should enough money have been deposited to continue the operation of the machine, and other buttons depressed, the general contact will be held down by the remaining buttons after the first one has been pressed out. There is, however, a secondary contact which rotates with *X* of *Fig.* 7, when lever *X* presses out a depressed button,

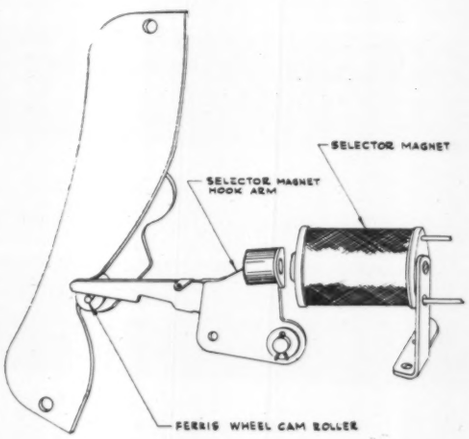


Fig. 8—*Hook arm holds cam roller out of contact until a record is to be played*

this secondary contact closes the circuit regardless of whether or not other buttons are depressed. If four records have been selected and five paid for, the fifth played will be the one immediately following the fourth selected, with the action as related in the foregoing where no record was selected. Buttons depressed through an error can easily be snapped out automatically by use of the center button on the selector.

In all coin-operated machines the coin chute is one of the most important mechanisms. The operation of the machine by slugs will materially cut down the revenue of the owner, while some types of slugs such as those made of paper or linoleum are liable to jam the coin mechanism and tie up the equipment until adjustments have been made. In the machine being described, the problems connected with the coin chute have been overcome by the inclusion of mechanisms which weigh, measure and inspect the coin automatically. This chute is shown in

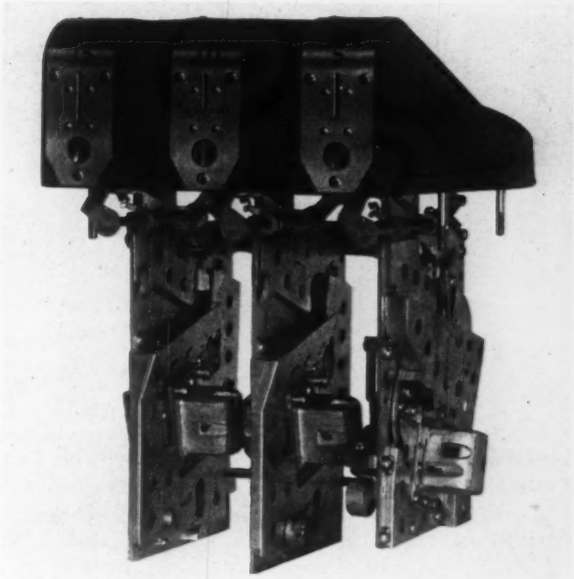


Fig. 9—*Coins are weighed, magnetically tested, and bounced to insure rejection of slugs*

Fig. 9. As the coin enters the first opening it slides down an incline and must jump a gap into the interior coin mechanism. Obviously if a slug that is too heavy is used, it will not jump this gap. In the interior there is a hinged opening that will permit the coin to drop through only if its weight is sufficient to overcome the force of the spring, slugs that are too light being thus eliminated. Also, there is a magnet which draws slugs of magnetic metal out of the proper path, and a bounce plate past which the coin can progress only if the metals which make up its composition are of the right proportion to give the proper amount of bounce and not too much. All rejected coins and slugs return through the outlet chutes into an opening at the front of the machine. Thus everything put into the slot with the exception of genuine coins is returned through the scavenger before it has an opportunity of working the starting switches previously mentioned. Should one of these foreign materials jam the entrance of the slot or some interior part, it is only necessary to turn a button at the top of the coin mechanism and all interior gateways open wide to the scavenger, returning the offending piece. This permits the removal of bent coins without the necessity of complicated servicing.

Combining as it does ingenious, carefully planned mechanisms with practical design from the appearance standpoint, this automatic phonograph illustrates how the art of the machine designer can be blended with the talent of the industrial designer to produce machinery that will attract favorable attention, lead to buyer action, then give the buyer a reliable, trouble-free return for his investment.

Scanning the Field . . . FOR IDEAS

IN INDUSTRIAL X-ray work the problem of supporting the locating tube and leads in the desired position for radiographing castings and other large and irregular parts often is difficult. Settings for angle and height present the biggest problem as the part cannot be located to suit every exposure.

This problem has been solved in the Schenectady laboratory of General Electric Co. by the use of the "lazy tongs" principle. The tongs, shown in *Fig.* 1 are made of kiln dried maple, treated to keep out moisture, and are of double design to give lateral rigidity. They are hung from a traveling overhead support by means of an inverted turn table which gives 180-degrees revolution. The tube is mounted in a maple bow held adjustably in a wooden clamp at the lower end of the tongs.

Control is through a system of ropes and pulleys and the high potential leads are carried to the tube terminals through insulated pulleys on arms extending from the tong support. As is obvious from the illustration the tube can be located properly for radiographing at any angle, height or location within the lead lined chamber housing the apparatus.

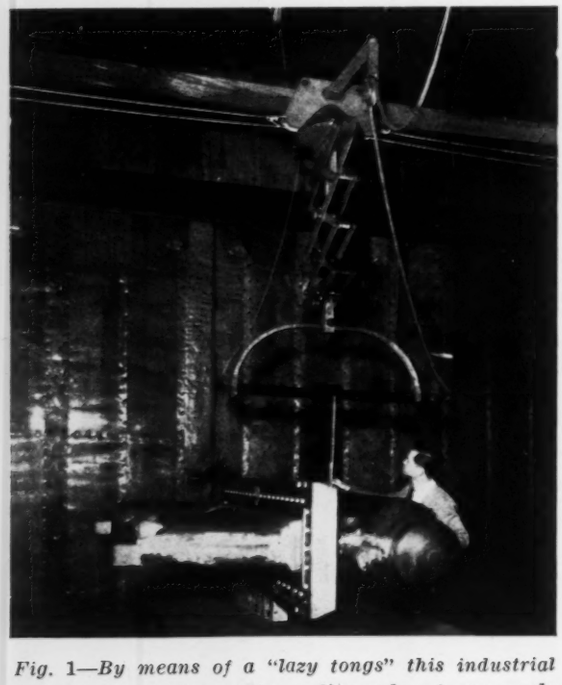


Fig. 1—By means of a "lazy tongs" this industrial X-ray tube can be set for radiographs at any angle

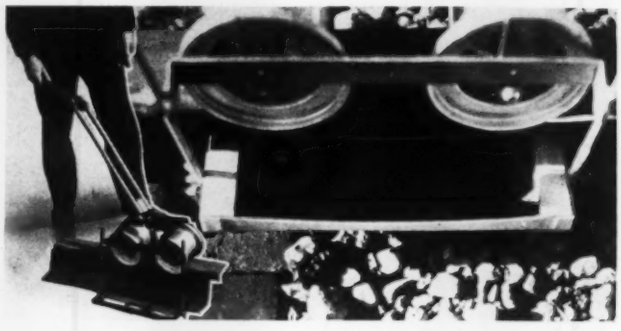


Fig. 2—Hidden defects in rails are revealed to inspector through medium of traveling magnifying mirror

MIRROR AIDS RAIL INSPECTOR

MOST people are familiar with the meticulous inspection which is given to wheels and other parts of the running gear of a fast train at every important stop. It is not so generally realized, however, that the complete transportation machine consists of train and track together, and that rails must constantly be subjected to equally rigid inspection.

To speed up and at the same time to make more effective the work of the rail inspector, or track walker as he usually is called, a simple optical device has been developed by Magnetic Signal Co. This rail inspector is shown in use and in detail in the combination cut, *Fig.* 2. It consists of a light truck with two double-flanged wheels, an adjustable handle and adjustable, curved, magnifying mirror. Setting the handle for his normal walking position and setting the mirror to give him a comprehensive view of the

web and underside of the rail head, the track walker simply pushes the machine ahead of him along the rail, watching the mirror for reflections of flaws, cracks and corrosion which otherwise would be hidden from view. The right-hand portion of the cut shows a serious split near the junction of head and webb, as it appears to an operator using the device as indicated at the left side of the cut.

THIS CONVEYOR BELT HAS A SOLE

ORDINARILY a conveyor belt has to give dual service, that of power transmission or pulling, and that of "carrying on its back" the load of material. Its usefulness as a power transmission element would be much longer were it not for the direct wearing action on its top surface, particularly when the material conveyed is coal, ore, broken stone, etc.

To give maximum life to the most costly part of the belt, which is the tension or power transmitting part, Boston Woven Hose & Rubber Co., has developed a duplex system which functions as shown in *Fig.* 3. Two belts are used, the outer — which corresponds to the sole of a shoe or the tread of a tire — being designed primarily to resist direct abrasion, while the inner is the power transmitter and is under tension. At the ends of the system and at the underside, this outer belt runs loosely over its own rollers, which are free running. At the top it rests on

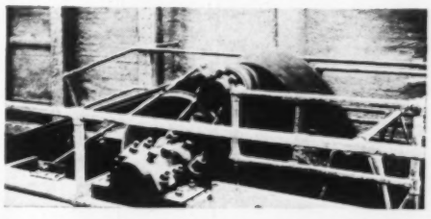


Fig. 3—Conveyor belt is protected by an independent renewable tread

and completely covers the power belt, by which it is driven through surface contact.

When the outer belt is nearly worn through it is replaced, as is a worn sole on a shoe. The protected drive belt will outwear several of these "wear sheet" belts, which cost very much less than does an ordinary dual purpose conveyor belt and are said to have about the same useful life.

RING-SHAPED UNITS HEAT AIR

FOR industrial process work a blast of heated air frequently is required and it sometimes is difficult to strike a proper balance between the volume of air required and the correct temperature at the delivery end of the heater.

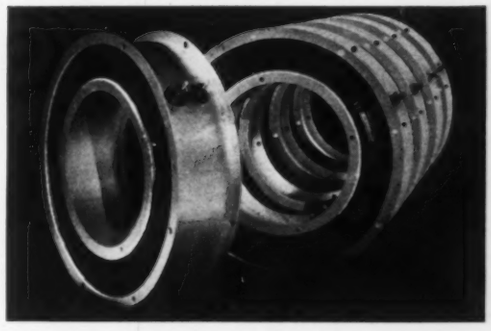


Fig. 4—Electric air heater can be assembled to give volume and temperature required

To achieve this end electrically, Edwin L. Wiegand Co. has developed a system of ring-shaped heating elements which are assembled into the form of a tube, as shown in *Fig.* 4. As many units can be assembled as are required to give the desired heating effect to the blast of air passing through the rings, preheating to 500 degrees Fahr. being easily achieved by installations now in use. Volume of air heated and degree of heating depend of course upon the number of elements used and kilowatt capacity provided.

JOINS PIPE WITHOUT THREADS

CONNECTING of pipe by conventional means often presents difficulties, as for instance in hydraulic and air lines built into industrial equipment. This is true also when thin-walled tubing is used, as threads weaken it seriously.

A practical method of connecting plain-end pipe is provided by Dresser compression fittings, of which *Fig.* 5 shows a standard length coupling. Ells, tees and adapters also are available. They are installed by the use of a wrench, two follower nuts being screwed up on the body, thereby compressing resilient gaskets of rubber compound tightly around the outside of the pipe. This gives an effective seal but at the same time allows for minor deflection and in-and-out movement of the pipe.

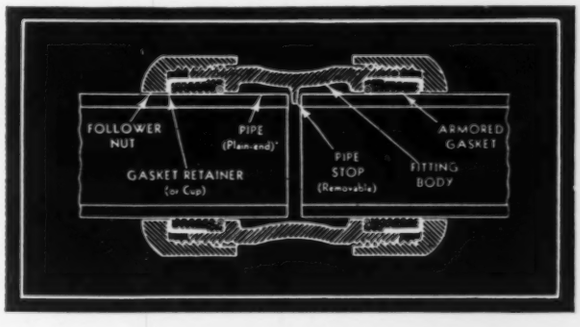


Fig. 5—Pipe can be connected without threading, by use of this type of compression fitting

Form 923 10M—7-23-35

DRAWING INDEX

.....Z..... FILE.....

SIZE SHEET	TITLE	PART NUMBER

DATE DRAWN..... .....SHEETS

DRAWN BY.....

Fig. 1—Index cards such as these give complete details on all tracings

Simple Drawing Files

By Allen F. Clark

ONE WOULD naturally think that the numbering, filing, recording and locating of considerably more than two million tracings would be an extremely involved process. With many of the systems now in use this would undoubtedly be true as the systems themselves are complex and the complexity ordinarily grows in proportion to the increase in the number of tracings.

This is not true, however, of the system used by Ford Motor Co., an organization which not only has over two million tracings on file but also one which is constantly adding to this total. At the Ford Rouge plant extreme simplicity marks every step in the control of tracings. This simplicity has proved to be the best procedure as there has not been any confusion in numbering, any difficulty in keeping track of tracings, or any of the other common filing troubles despite the large number of men and tracings involved.

This large organization has found that for all practical purposes the use of an involved numbering system is unnecessary. They use, in fact, two numbering systems, both simple, one for what is known as the tool division (including machinery used in the plant), and the other for a parts division, or the parts actually used in the automobile.

The vast majority of tracings are included in the tool system of numbers, known as Z numbers. Here every division in the field is given a Z number which ranges from 1-Z to 116-Z at the present time. There is no limit to the classifications. Every effort is made to include drawings in the present range of Z numbers, but should a new classification be necessary there is no restriction that will prevent numbers over 116-Z being added. Also, no effort is made to keep associated parts, such as various foundry parts and machines in consecutive Z-number classification.

Form 917 3M—1 29-35

DR INDEX

Part No.....

Name.....

.....

OPER.	TI ING

Fig. 2—Part numbers, de dicatin are used as a master file t draw

These Z numbers are prefixed to a second number which progresses numerically through each division. Again there is no limit to how high this second number may go. It is entirely possible that some day this company will have a tracing numbered 218-Z-3,567,452. The 218-Z would indicate the division in the field. The suffix would fix the position of the tracing in that field.

The parts numbers, as might be

Form 2808G 5M—8-19-36

FORD ENGINEERING RELEASE

PART NAME

PART NO

DATE

SEE E. I. NO. E-

GROUP SHEET

NEW PART	NEW SPEC.	NEW OPER.	DRAWING SIZE	OBSOLETE	THIS SUPERSEDES RELEASE DATED	SPEC. INDEX NOTED

	48 CHASSIS	60F CHASSIS			LINCOLN K CHASSIS	LINCOLN KF CHASSIS			2 DOOR SEDAN 68 700	CLOSED CAB PANEL 68 707	ROADSTER 68 710	COUPE 68 720	4 DOOR SEDAN 68 730	CONVERTIBLE 4 DOOR 68 740	4 PASSENGER 68 750	FAB. ROBLET 68 760	QUARTER WINDOW SEDAN 68 770	SPORT DELY 68 780	STATION WAGON 68 790				LINCOLN 4 DOOR SEDAN H903	LINCOLN 4 DOOR SEDAN H902
Mfg Dpt	PRODUCTION																							
	SPEC. EQUIP.																							
M	51 CHASSIS	51F CHASSIS	51 CHASSIS	51F CHASSIS			CLOSED CAR 67 810	CLOSED CAB PANEL 67 817	PANEL DELY 67 820	PICKUP 67 830	OPEN CAB PANEL 67 840		CLOSED CAB 51 810	CLOSED CAB PANEL 51 817	OPEN CAB PANEL 51 840			PLAT. FORM & STAKE 51 900	BACK BODY & PANEL 51 905	PANEL DELY 110 W.B. 51 920		PLAT. FORM & STAKE 51 950	4 DOOR SEDAN 110 W.B. 51 955	DUMP TRUCK
B	PRODUCTION																							
Pd	SPEC. EQUIP.																							
Patt																								
Mca																								
Cry																								
McC																								
Bel																								
Fra																								
Jap																								
Ger																								
Sco																								
Bar																								
B 51																								
Boat																								
Whar																								
Mix																								
Klop																								

REMARKS

EFFECTIVE

PARTS STOCK

SUPERSEDES REPLACED BY

CHECKED BY APPROVED BY ENGINEER

ABOVE REQUIREMENTS APPLY TO BOTH R. H. AND L. H. DRIVE UNLESS OTHERWISE SPECIFIED
FOR ITEMIZED REQUIREMENTS ON STANDARD PARTS SEE PARTS LIST

Fig. 3—Engineering release sheet for drawings is permanently filed under the part name and by part numbers

Fig. 4—No tracings may be taken from the files unless requested on standard forms

DRAWINGS WANTED
BLUE PRINTS WANTED

Form 1221 75M—2-4-34

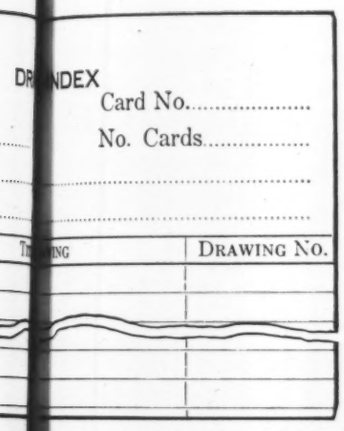
Date 19

DWG. NO.	COMP.	SHEET NO.	DET. NO.	Amt. B. P.	REMARKS

Requested by Dept. Loc.

Received

Speed Design Work



...dicating a class of equipment, ...drawings in the drawing index

expected, are definitely tied in with the model of the car, a prefix on these numbers such as 48 indicating the model. The next step in these numbers is to indicate the body style. For this a number has been assigned which indicates this same body style for all yearly models of the car. A number of this type is 700 which indicates a 2-door sedan. Added on to this is the number of the individual part, again the same throughout yearly changes. This gives us a number such as 68-700770 which becomes recognizable to the initiated as, say, the floor board on a 1935 two-door sedan. By this system 999 different parts can be indicated.

Occasionally it is necessary to change the design of the individual part. When the design is changed the two tracings indicating this particular floor board have added to them the suffix —A1 and —A2. When the changes are extensive, these suffixes become —A and —B which again can be —B1 and —B2. Thus the part number indicates definitely the yearly model, the body style, the particular part involved, and whether or not a single part drawing covers all of these parts throughout the year.

Control of the parts numbers is maintained by an index which easily fixes the exact number to be employed. Data on the tool numbers, or Z numbers, is contained in a numerical and alphabetical index. This index will show 95-Z as electrical appliances, 37-Z as automatic machines, etc., and "Machines, automatic, 37-Z". The last part of the drawing number is fixed by a card showing the number of drawings in that division.

It is the card index which permits the easy location of drawings. In the preparation of this index the designer, upon the completion of a drawing, makes out a notation of the data needed on a piece of 3 x 5 scratch paper. From this notation the file clerks type out Drawing Index cards such as shown in *Fig.* 1. These are then filed numerically as to Z numbers and numerically under the Z numbers. A second card index, *Fig.* 2, is filed by parts numbers as these numbers definitely indicate a class of equipment, including subdivisions in the field so that the comparatively few drawings in any subdivision can be located easily.

Regardless of the final fate of the tracing, these cards never leave the index files. If a drawing is superseded it is so indicated on the index file card, and the new drawing number is shown. Note that the new drawing number does not necessarily have any relation to the old in the case of these tool drawings. If the tracing is obsolete, it is also noted on the card so

Fig. 5—Engineering change notices are prepared in detail for each part affected, and widely distributed

Form 2816 2M—4-13-36

FORD ENGINEERING CHANGE NOTICE

PART NAME

PART NO.

DATE

SPEC. CHANGED | OPER. CHANGED | SPEC. INDEX NOTED | GROUP | SHEET | SEE E. I. NO.

DETAILS OF CHANGE

Mfg Dpt

M
B
Bd
Patt
Wes
Cry
McC
Bel
Fra
Jap
Ger
Sco
Bar
B Bl
Bost
Wmar
Mix
Klop

OBJECT

EFFECTIVE

PARTS

STOCK

CHECKED BY | APPROVED BY | ENGINEER

that a reference to this card shows immediately the drawing number, its standing, the type of drawing, the part number, date drawn, designer, number of sheets, and sheet size.

Once the drawing has been located, it is a simple matter to find it in the tracing files. Filing of tracings is broken down to filing in numerical order *in the varying sheet sizes.* As noted, the index card shows the sheet size which will be one of three, W, X or Y. As all X size drawings are filed together as to Z number and index number, all that is necessary is to determine the size from the card and look for the drawing in the proper file.

Finding of parts drawings is even more simple as the classification of numbers indicates exactly the drawing desired. When such a drawing is completed, the designer writes out an engineering release sheet as shown in *Fig.* 3. This sheet is permanently filed under the part name and by parts numbers, and also gives exact details on the tracing. Again the filing of tracings is controlled by the drawing number and by the tracing size.

Form 2914 2M—1-28-36

ENGINEERING INFORMATION NO. _____ DATE _____

F.OCH DUNTON DAGENHAM WALKERVILLE KROLL-2 KELLOGG MARTINDALE
WAGNER HAUCK BOSTEDOR-2 JOHNSON CRECELIUS

SUBJECT _____

Mfg Dpt

M
B
Bd
Patt
Wes
Cry
McC
Bel
Fra
Jnp
Grr
Sco
Bar
B Bl
Bost
Whar
Mix
Klop

CHECKED BY | APPROVED BY | ENGINEER

INDIVIDUAL RELEASES AND NOTICES MUST BE USED FOR DETAILED AUTHORITY AND RECORDS

Fig. 6—*A summary of all changes made on a certain part is prepared on engineering information blanks such as this one*

When it is desired to remove any tracing from the file, the engineer desiring this tracing makes out the form shown in *Fig.* 4. One of these sheets is made out for each drawing number desired, although one can indicate several sheets under the same drawing number. Tracings are never taken from the engineering department, and the drawing request card makes the designer asking for the drawing responsible for the return of that particular tracing. These request cards are filed in the drawer from which the tracing was removed. A holder is provided in each drawer, and cards indicating the removal of a tracing are filed by number in this holder. Tracings not in the drawer are checked up periodically so that none will be held out when not needed.

As changes to the tool drawings classified by Z numbers affects only machinery used in the plant, it is merely necessary to note the change on the index cards. The tracings obsoleted or superseded are taken from the active file and placed in a separate file with other inactive drawings, again filed by size and Z number.

However, changes to parts drawings have a more far reaching effect. These changes must be reported to all of the plants, to foreign offices and to any others directly affected. These changes are first recorded on the form shown in *Fig.* 4 for each part. Details of the change appear on the "Engineering Change Notice" of *Fig.* 5, again for each part affected, and a summary of the changes is given on the Engineering Information of *Fig.* 6. All of these forms are printed in special ink for reproduction by the transference method, and the changes are typed with a special typewriter ribbon. With this one record prepared any number of copies required can be quickly run off.

With these comparatively simple steps, considering the number of tracings involved, complete and accurate record is kept of every tracing in the files. The very simplicity of the system might suggest to many engineering departments that it might be well to check the advantages gained before adopting a system that is too complex for the best results. Simplicity often pays the biggest dividends.

Mechanical Engineers Nominate

JAMES H. HERRON, president, James H. Herron Co., Cleveland, has been nominated as president of the American Society of Mechanical Engineers by the regular nominating committee of the society. Vice presidents nominated by the committee are: J. A. Hall, professor of mechanical engineering, Brown university, Providence, R. I., at present a manager of the society; J. M. Todd, consulting engineer, New Orleans, La., also a manager of the society; and R. J. S. Pigott, staff engineer in charge of engineering, Gulf Research & Development Co., Pittsburgh.

Nominations for members of the council of the mechanical engineers' group to serve as managers are: Kenneth H. Condit, editor, *American Machinist,* New York; E. W. Burbank, Dallas, district manager, Allis-Chalmers Mfg. Co., Dallas, Texas; and S. W. Dudley, dean of the Yale school of engineering, Strathcona Professor of Mechanical Engineering, Yale university.

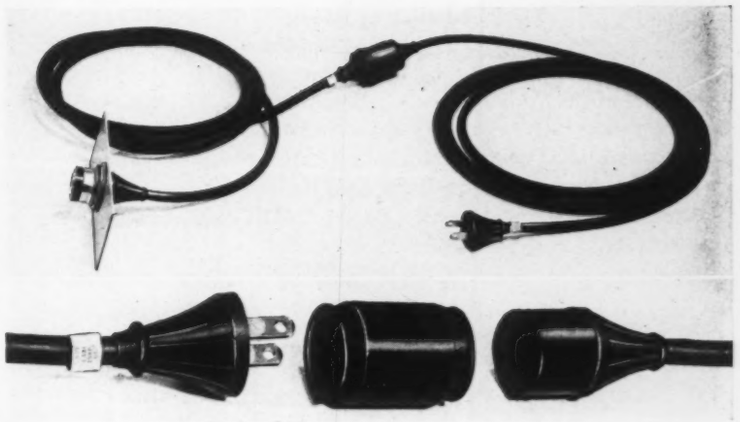


Fig. 1—Cord set used as extension. Rubber sleeve binds and seals joint

Consider the Cord Set as Vital Machine Part

By F. C. Dazley
General Electric Co., Bridgeport, Conn.

Fig. 2—Examples of small connector devices having standard prong spacing

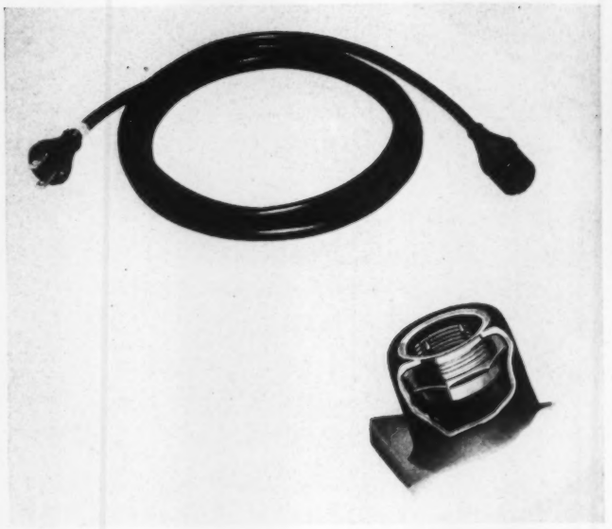
DESIGNERS of portable electrical devices too frequently overlook the importance of giving careful consideration to the subject of cord sets. These indispensable elements deserve specialized attention while the appliance still is on the drafting board. By attention at that stage, possibilities of field service troubles, customer dissatisfaction, poor appearance on display and high assembly costs can be eliminated to a surprising degree.

With materials and processes available today, it is entirely practical to design portable appliances with approved cord sets "styled" to be harmonious with the rest of the design. Ends can be molded-on or not, as desired. Prime consideration of course is safety and that will be met if the cord sets which you design or specify meet requirements for approved listing by the Underwriters' Laboratories covering their application. Ample current carrying capacity must be provided, in line with the Electrical Code and other Laboratory literature.

Detachable or Attached?

Next comes the question as to whether the cord set shall be of detachable or of permanently attached type. The decision here may have direct bearing on user convenience, ease of replacement in case of failure, appearance of your product when on display and possibly on assembly line costs. The finest cord set can be abused

Fig. 3—Right—Detachable cord set with ends molded on. Also one method of mounting receptacle on appliance



to the point of failure. Replacement of a detachable cord set entails only a visit to a dealer whereas a small appliance with permanently attached cord may have to be returned to the factory.

It is a fact that in the case of a toaster or grill for instance, the average housewife prefers a detachable cord set that can be put away safely and out of sight when the appliance is not in use. By the same token, in the dealer's display even a neatly "hanked" attached cord is liable to detract somewhat from the appearance of the merchandise.

To accommodate a detachable cord set it is necessary to equip the appliance with a suitable male receptacle, such as is shown in *Fig.* 2. The cord then will have a mating connector body on its "appliance" end and a male plug on its "wall" end. Small and neat flush mounting receptacles with standard prong spacings are now available for a wide variety of applications. Of those shown in *Fig.* 2, the ones having exposed binding screw terminals on the back are described as "back wired", while those arranged for concealed wiring are described as "front wired". Single-hole flush mounting or two-screw flange mounting are optional and polarized male receptacles can be obtained if desirable.

Initial Cost Is Reduced

The small additional cost of the connector body and receptacle is often cancelled through elimination of handling of cord sets on the assembly line. Cases have been observed where attached cord sets, after passing through the assembly line, have required cleaning and rehanking.

When selecting the connector body and male plug for a cord set remember that you are providing for transmission of a potent form of energy. Adequate strain relief must be provided to protect soldered connections within the plug and connector body. The detachable set shown in *Fig.* 3 provides strain relief through molded-on devices at both ends. This set is designed so that it also can be used as an extension, as shown in *Fig.* 1. The connector body in this case has standard prong chute spacings and a rubber sleeve is snapped on over the junction

(*Concluded on Page* 73)

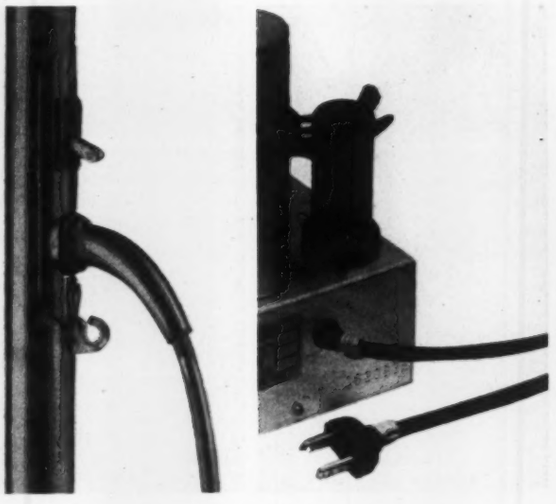


Fig. 4—Center of page—Cord sets "styled" to match appliances. Fig. 5—Right—Provisions for strain relief

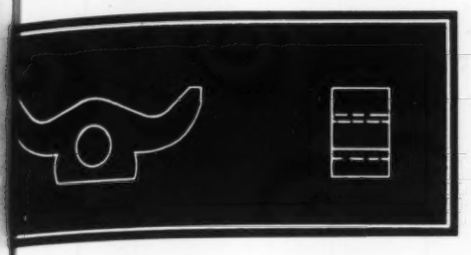


Fig. 1—Screw machine clutch lever on which selection of material was paramount

New Requirements

Dictate Changes in Materials

By
N. B. MacLaren
Experimental Designer, Brown & Sharpe Mfg. Co.

AN EVER-increasing demand for more production from each type of machine is being expressed by users of machine tools. The designer, aware of this, is constantly planning new designs or changes to the present basic machines. As in most cases it means a speeding up of operations, a concentrated effort is made by the designer to speed up without changing the basic design.

To innovate and complete an entirely new design is oftentimes a lengthy procedure, and in most cases expensive. No doubt the problem may be answered by new designs. This means, however, new drawings, new patterns, new dies, new tooling equipment, new methods of scheduling and many other revisions. It also makes obsolete the present tooling equipment.

In many cases the problem may be answered and effective results obtained by giving careful study to the materials used. For instance, the speeding up of the machine with its present clutches will cause their breakage or will create excessive wear. Possibly a change in material or heat treatment will overcome this. The speeding up of a spindle may cause overheating and subsequent seizure. Perhaps a change in bearings, a change in method of lubrication, or a change in spindle material may prevent this, and so on. Numerous other cases could be cited where increased speeds and pressures create damage to respective parts of the machine.

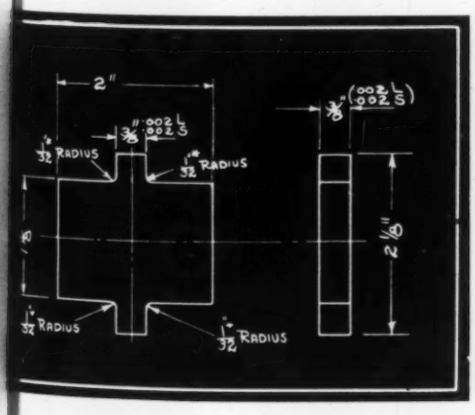


Fig. 2—Lugs of this impact sample approximate the dimensions of final clutch lugs

When such conditions arise, the first duty of the designer is to study the materials used in the design, and also to study means of increasing the strength of the design by carefully considering heat treatment. New materials with greater physical strengths will frequently offer a solution to the problem.

However, even if new materials are the answer, in many cases unforeseen obstacles arise which become annoying and sometimes discourage the designer. The machinability question creates impatience. We frequently hear such statements: "That sample lot of three spindles machined well. Why do not these 100 machine as well? The tools burn—a smooth cut cannot be obtained—duplicate sizing is very difficult to obtain, etc. Why so much distortion and 'soft skin' on this lot of 100 clutches?" Such problems are aftermaths and have to be gradually worked out in practice, and recorded thus as experience for future reference.

At the Brown & Sharpe Mfg. Co. problems of this nature are frequently occurring, and the purpose of this article is to point to one or two cases where solutions were obtained not by expensive design changes but by careful revision of material and heat treatment.

The automatic screw machine has probably kept the designer as active as any machine in the machine tool industry. The advent of free cutting screw steel and high sulphur screw steel necessitated increasing spindle speeds and clutch

movements. These changes created new conditions such as increased impact, increased fatigue, increased wear, etc.

Fig. 1 is a sketch of a conventional screw machine reversing spindle clutch lever. The tolerances of this part are close. It is very important that the bearing points be in correct relation with the hole. These points and the sides of the hole are exposed to heavy pressures.

Hole Shrinks Slightly

When these parts were made from an oil-quenching chrome-nickel steel, the hole was made 0.002 large in the soft condition. After hardening, the hole would shrink slightly more than 0.002. Very little lapping would be required. When it became necessary to change this material, a chrome-nickel case hardening grade of steel was selected. Extensive wear tests proved this material to be decidedly superior. Leaving the hole 0.002 large as in the oil-hardening grade of steel did not give consistent unformity after hardening. Possible variations in the steel or variations occurring during the long carburizing period were plausible reasons for such inconsistency. The hardness produced made lapping very difficult and expensive. Tendency was for hole to shrink.

To overcome this condition the hole was made standard and the stock caused by the shrinkage in carburizing was reamed to standard size before final hardening. Final heating is done in cyanide and quenching is done in brine. The surface produced is extremely hard, a deep case to support the heavy pressures is obtained and the wear value has been greatly improved.

Hardness and Structure Duplicated

Machinability presented some trouble. Careful study of cutters, cutting lubricants, and structure of steel was necessary. Having determined the best structure of steel, a specification was set up and placed in the hands of the steel manufacturer. In purchasing or ordering the steel, reference is made to this specification. The steel mill uses every precaution to duplicate hardness and structure.

The screw machine clutch as shown in *Fig.* 3 is another interesting problem. Here again it was necessary to change material. The cam paths, due to the action of the trip lever, commenced to pean over. The lugs under continual impact would sometimes break at the fillets. Selective drawing of the lug to create toughness was difficult and expensive, the difficulty being that the heat would creep back to the cam path and create softness. The clutch teeth have to be hard to prevent peaning and sufficiently tough to prevent breaking. To change the design of these clutches would have involved countless other changes in adjacent or neighboring parts. It would, as stated previously, involve new drawings, new patterns, new tooling equipment and would make present tooling equipment obsolete.

Follows Special Selection Procedure

Several steels were selected for this application, each one having possible merits. Analysis and catalog data were the basis for selection. To test all these steels, which numbered over fifteen, would require several hundred hours, not to mention the time involved to make the clutches of the different materials. The following procedure was adopted:

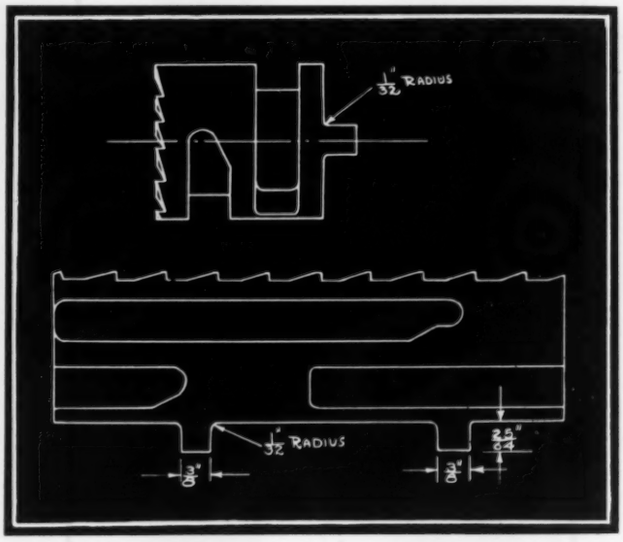


Fig. 3—*It was necessary to change material in this screw machine clutch to meet new requirements*

As the clutch is exposed to impact and peaning, the best combination of satisfactory toughness and best peaning resistance should give the desired results. A clutch was selected whose lugs were sufficiently tough. An impact sample such as shown *Fig.* 2 was made of this same material. The lugs of the impact sample approximated the dimensions of the clutch lugs. The heat treatment of the impact sample was such as to give the same hardness of the clutch lug.

This impact sample was then tested in a drop weight impact testing machine. This machine consists of a 10 pound weight which is permitted to drop at intervals of 6 inches. The total energy recorded

TABLE I

Summary of Impact Test Results

No.	Type of Steel						Impact	Hardness Scl. Rock. C.	
20	Carbon	.65	Moly.	.80	Mang.	.90	2000	78	56
22	Carbon	.50	Chrome	1.10	Nickel	1.75	1720	74	55
13	Carbon	.45	Chrome	.60	Nickel	1.25	1305	72	55
24	Carbon	.50	Silicon	1.00	Moly.	.50	2030	76	58

on this "accepted toughness sample" was 1000 inch pounds. The hardness, however, was approximately 60 Scleroscope which was entirely too soft to withstand peaning.

Knowing the impact of 1000 inch pounds to be satisfactory, it was then necessary to find a steel with at least this impact but with a higher Scleroscope reading. In fact, it was previously determined that a clutch with a reading under 70 would not satisfactorily withstand the peaning to which the part would be subjected.

Impact Test Eliminates Many Steels

Impact samples were made from all the steels selected for test. All samples were milled alike and all were hardened at recommended heats and drawn at various temperatures. Impacts were made at different drawing temperatures, all steels having impacts under 1000 inch pounds and hardness under 70 Scleroscope were eliminated. TABLE I is a summary of the four steels which survived the tests, giving the chemical composition of the steels.

Any of the steels shown in TABLE I would be satisfactory in respect to toughness. Choice in this respect would depend on machinability, cost of material and heat treatment. It was felt, however, that considerable variation in peaning would result.

To determine this effect the broken impact samples were used. Sharp corners were ground and the samples inclined at an angle of approximately 45 degrees. A hardened steel hammer, operated mechanically, was allowed to drop on this sharp edge for a definite time. The flat produced was a measure of peaning, the wider the flat the less resistance to peaning. TABLE II gives the results of the peaning tests.

Selects High Molybdenum Steel

The steel selected for satisfactory toughness and best resistance to peaning was a medium carbon, high molybdenum steel No. 20. Since this material was adopted, practically no trouble has been experienced with these clutches as applied to the machines.

As in the case cited previously, the machinability of the clutches was solved by experimenting with various heat treatments. The best structure for chucking, turning, gear cutting, etc. was determined and a specification was formed and placed in the hands of the steel manufacturer.

These two cases are being cited to illustrate where the increasing demands of the machine were answered by change in material with the least possible expense. The same results might have been obtained otherwise but would have necessitated expensive, and unnecessary, changes in design.

TABLE II
Results of Peaning Tests

No.	Type of Steel						Peaning Value
20	Carbon .65		Moly. .80		Mang. .90		.0114
22	Carbon .50		Chrome 1.10		Nickel 1.75		.0155
13	Carbon .45		Chrome .60		Nickel 1.25		.019
24	Carbon .50		Silicon 1.00		Moly. .50		.013

Schenectady's Electrical Industry Established Fifty Years Ago

FIFTY years ago Thomas A. Edison moved some of his electrical manufacturing activities from a congested district in lower New York city to an unused locomotive plant in Schenectady. On that removal hinged to a large degree the future of the city of Schenectady. Nevertheless it was only through last minute efforts of a few public spirited citizens that a few hundred dollars were raised to complete a deal which was destined to bring untold millions of dollars into the city and to make it one of the great centers of the electrical industry.

No more convincing proof is needed of the value added to raw materials through invention and subsequent manufacturing, of the thousands of jobs created and of the betterment of conditions for mankind generally, than that given by what grew out of the genius and creative efforts of Edison and his associates at Schenectady within a period of fifty years. In 1886 what was to evolve into the General Electric Co. consisted of two old buildings with 70,000 square feet of floor space, in which three hundred workmen were employed. The company now occupies 6,500,000 square feet of floor space and employs twenty-four thousand people in a city of which the entire population was only fifteen thousand when the enterprise was started.

Commenting on impressive technological advancements, Owen D. Young said, "Broadly speaking, there has not been a time during the past fifty years when anything manufactured was not to some extent at least—obsolete by the time it was put into service. So rapid came invention and improvement fostered by research, that in this growing art it could never be said and cannot be said today that what is—is. It could only truthfully be said that what is—is not, in the sense that what is is too obsolete ever to be built again.

"The vision of Thomas A. Edison was not impaired by hopelessness. His industry was not limited by rules or plans. The story of his life makes a jest of the slogan, 'What is not—cannot be'."

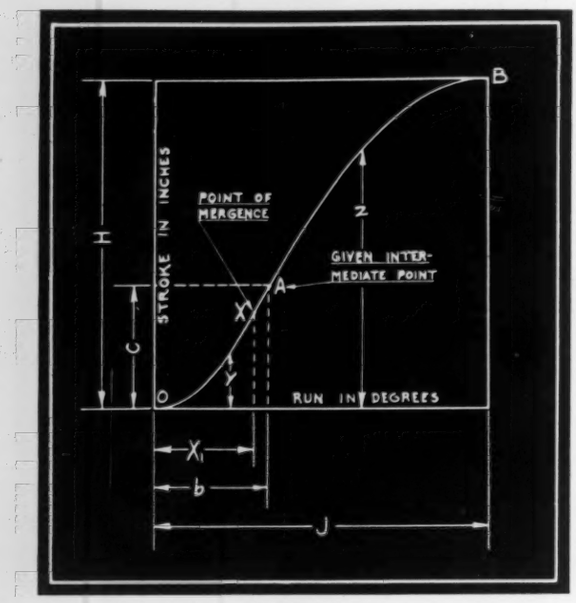


Fig. 1—First half of opening stroke must be rapid to avoid wire drawing in design of this cam

By Trescott S. White

Only Usable Equations Satisfy the Busy Designer

TABLE I
Tabular Calculations for Acceleration Curve
$y = 0.00145\ x^2$

(1) x	(2) x^2	(3) $\frac{1}{2}k_1$	(1) × (2) gives $0.00145\ x^2$
0	0	0.00145	0.000
4	16	0.00145	0.023
8	64	0.00145	0.093
12	144	0.00145	0.209
13.2	174.2	0.00145	0.253

MOST discussions on the laying out of cam curves offer equations and mathematical curves in general, but fail to make them directly usable to the busy engineer. The following presentation outlines the method whereby simple formulas are obtained for laying out and analyzing uniform acceleration curves. Formulas and constants are expressed in terms of desired stroke and degrees of run. An example is worked out completely to illustrate the method.

The equations and characteristics are more or less well known for cases where the acceleration and deceleration rates are equal. Therefore, we will deal only with the cases where the rates of acceleration and deceleration are different. In other words, the problem of laying out constant acceleration and deceleration curves between two given levels so that one of the curves passes through a given intermediate point.

In the case of valves for internal combustion engines, the first half of the opening stroke must be rapid to avoid wire drawing, while the last half of the opening stroke must be slow to reduce the spring force required. This case well illustrates the method.

Suppose the stroke or total rise is to be H inches, the run J degrees and one of the curves must pass through the point A (See *Fig.* 1). The rise of point A is c inches after b degrees of travel. The cam profile consists of an acceleration curve OX and a deceleration curve XB as indicated in *Fig.* 1. A is the intermediate point through which one of the curves must pass.

The general equation for any constant acceleration curve as given by text books is:

$$y = (1/2)\,kx^2 \quad \text{.....(1)}$$

In this equation y equals the stroke or rise of the cam follower, x represents the amount

the cam has turned, and k is a constant determined by the conditions of the design, namely, total stroke, total run, and the location of the intermediate point through which the curve is to pass.

Application of the general equation to the curves shown in *Fig.* 1 gives for the acceleration curve:

$$y=(1/2)k_1x^2 \quad \ldots\ldots(2)$$

and for the deceleration curve:

$$z=H-(1/2)k_2(J-x)^2 \quad \ldots\ldots(3)$$

Substitution in the equation for z at the intermediate point through which it passes affords means for evaluating k_2, the constant for the deceleration curve. It is found to be:

$$k_2=2(H-c)/(J-b)^2 \quad \ldots\ldots(4)$$

In this equation H is the total stroke or rise and c is the lift after travel b.

Substitution in the equation for y at the point of mergence affords means for evaluating k_1, the constant for the acceleration curve. It is found to be:

$$k_1=2H(H-c)/[J^2(H-c)-H\ (J-b)^2] \quad \ldots\ldots(5)$$

Since the slopes of the two curves must be the same at the point X where they merge, the distance x_1 to the point of mergence can be obtained by differentiating each equation, setting them equal to each other and solving for x. It is found to be:

$$x_1=J-(2H/k_2J) \quad \ldots\ldots(6)$$

Thus all the data necessary is available; the equation for the acceleration part of the curve with constant evaluated; the equation for the deceleration part of the curve with constant evaluated; and the distance to the point of mergence of the two curves. All that remains is to show the use of these formulas by means of an example.

Gives Typical Example

Let us lay out a cam profile with a total lift or rise of 0.843 inches, H, in a run of 44 degrees, J. It is desired that the lift be 0.320 inches, c, after a travel of 15 degrees, b. (This defines the intermediate point through which one of the curves must pass.)

The constant for the acceleration curve is by formula (5),

$$k_1=\frac{(2)\,(0.843)\,(0.843-0.320)}{(44)^2(0.843-0.320)-(0.843)\ (44-15)^2}=0.00290$$

The equation for the acceleration curve is by formula (2),

$$y=0.00145\,x^2$$

TABLE I shows a convenient arrangement of calculations.

The constant for the deceleration curve is by formula (4),

$$k_2=2(0.843-0.320)/(44-15)^2=0.00124$$

The equation for the deceleration curve, by formula (3) is,

$$z=0.843-0.00062(44-x)^2$$

TABLE II shows a convenient arrangement of calculations.

The distance to the point of mergence, formula (6), is,

$$x_1=44-(2)\ (0.843)/(0.00124)\ (44)=13.2\ degrees$$

Tabular computations given in TABLES I

TABLE II
Tabular Calculations for Deceleration Curve

$z=0.843-0.00062(44-x)^2$

(1) x	(2) $J-x$	(3) $(J-x)^2$	(4) $\frac{1}{2}k_2$	(5) (3) × (4) $\frac{1}{2}k_2(J-x)^2$	0.843 − column (5) $z=H-\frac{1}{2}k_2(J-x)^2$
13.2	30.8	948.6	0.00062	0.5900	0.253
16	28	784	0.00062	0.4876	0.355
20	24	576	0.00062	0.3583	0.485
24	20	400	0.00062	0.2488	0.594
28	16	256	0.00062	0.1592	0.684
32	12	144	0.00062	0.0896	0.753
36	8	64	0.00062	0.0398	0.803
40	4	16	0.00062	0.0096	0.833
44	0	0	0.00062	0.0000	0.843

TABLE III
Summary of Formulas

Item	Case I Fast acceleration Slow deceleration $(C/H)>(b/J)$	Case II Slow acceleration Fast deceleration $(C/H)<(b/J)$
y	$\frac{1}{2}k_1x^2$	$\frac{1}{2}k_1x^2$
z	$H-\frac{1}{2}k_2(J-x)^2$	$H-\frac{1}{2}k_2(J-x)^2$
k_1	$2H(H-c)/[J^2(H-c)-H(J-b)^2]$	$2c/b^2$
k_2	$2(H-c)/(J-b)^2$	$2Hc/(J^2c-Hb^2)$
x_1	$J-(2H/k_2J)$	Hb^2/Jc
v_{max}	$H(RPM)/J$	$H(RPM)/J$
a	$3k(RPM)^2$	$3k(RPM)^2$

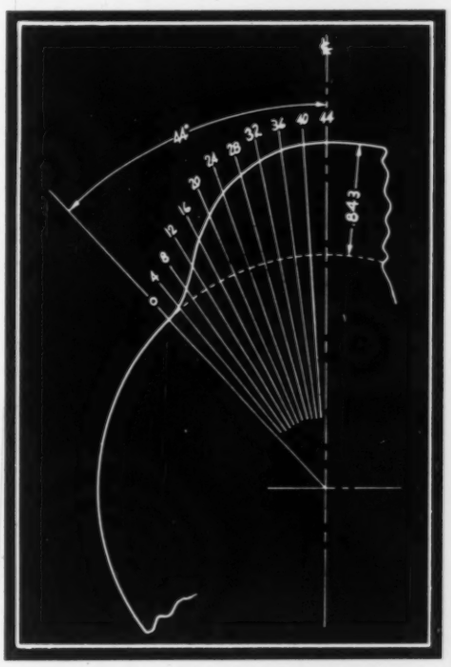


Fig. 2—Same curve as in Fig. 1 plotted radially from the base circle of a profile cam

and II are self explanatory. Greater accuracy can be obtained by using two-degree intervals instead of 4-degree intervals, however, this can best be determined by each individual problem.

Fig. 1 shows the curve resulting from plotting the values computed in TABLES I and II. *Fig.* 2 shows the same curve plotted radially from the base circle of a profile cam.

For the case where the opening or accelerating stroke must be slow and the closing or decelerating stroke fast, a development similar to the preceding yields the following formulas, the terms having the same meaning as for the first case:

$$y = (1/2)k_1x^2 \text{ (Same as equation (2)} \quad (7)$$

$$z = H - (1/2)k_2(J-x)^2 \text{ (Same as equation (3)} \quad (8)$$

$$k_1 = 2c/b^2 \quad (9)$$

$$k_2 = 2Hc/(J^2c - Hb^2) \quad (10)$$

$$x_1 = Hb^2/Jc \quad (11)$$

It should be noted that formulas for the first case apply only when c/H is greater than b/J. Formulas for the second case apply only when c/H is less than b/J. If c/H is more than twice b/J or less than half b/J neither set of formulas apply as it is impossible to pass constant acceleration and deceleration curves through the points.

A few more items are necessary to enable analysis of a proposed cam profile.

Maximum velocity occurs at the point of mergence of the curves and is found to be:

$$v_m = H(RPM)/J \quad (12)$$

In this formula v_m is the maximum velocity in feet per second, H is the total rise or stroke in inches, J is the degrees run, and RPM is the rotative speed of the cam.

It should be noted that moving the intermediate point through which one of the curves passes, changes the location of the point of maximum velocity but does not affect its maximum value.

Acceleration for either part of the curve is constant for that portion of the curve and is

$$a = 3k(RPM)^2 \quad (13)$$

In this equation a is the acceleration in feet per second and RPM is the rotative speed of the cam. Use k_1 for the acceleration part of the curve, and k_2 for deceleration part of curve.

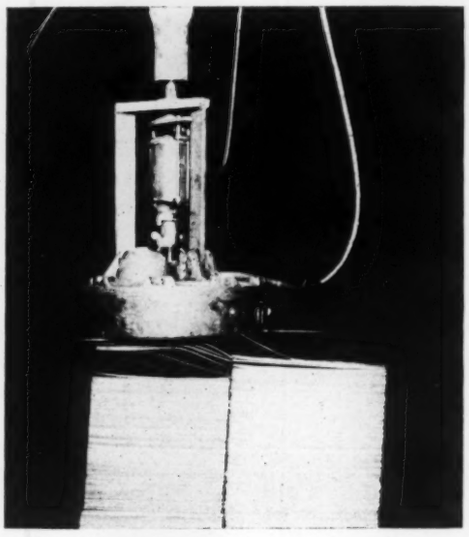
A summary of formulas is presented in convenient tabular form in TABLE III.

Thus it is seen that constant acceleration curves can be laid out and analyzed with very little effort.

Sheets Are Separated by Magnets

FOLLOWING the annealing of black sheets in piles in the process of making coke tin plate, the sheets must be separated. Ordinarily this is a tedious manual operation, but a method now has been developed by Bowen and Murray at Follansbee Bros. Co. whereby it is done magnetically.

The magnetic sheet separator shown herewith embodies a special electromagnet built by Ohio Electric Mfg. Co. This magnet, which is 29½ inches in diameter, has a curved and V-shaped working face, the center being about one inch out of level with the outer edge. On the top of the magnet is a tripod frame within which is loosely mounted a 25 cycle A. C. Syntron electric hammer equipped with a special tool having a head shaped like a large door knob. Magnet and hammer have separate controls operated from the cab of the crane by which the assembly is supported.



A specially designed electromagnet is the basis for this unique sheet separator

Use of the apparatus involves several distinct cycles. First, the magnet is lowered to the top of the pile of sheets and then a little more cable is payed out so that the hammer head also will rest on the top sheet. The hammer is then operated for about half a minute. Next the magnet is raised about 1½ inch and its current is switched on and off rapidly—an automatic quick drop and arc suppressor making this possible without damage to the controller contacts. Then this process is repeated at heights of 2½, 3 and 3½ inches, a further separation of the sheets occurring at each stage until finally practically 100 per cent separation is effected. The magnet is shown operating at the three-inch level, the manner in which the separation takes place being clearly indicated.

After having operated upon one pile of sheets through its complete cycle, the magnetic unit is shifted to, and goes to work on, another pile. Thereupon the separated sheets are removed from the first pile, are given individual inspection, and are sent on their way.

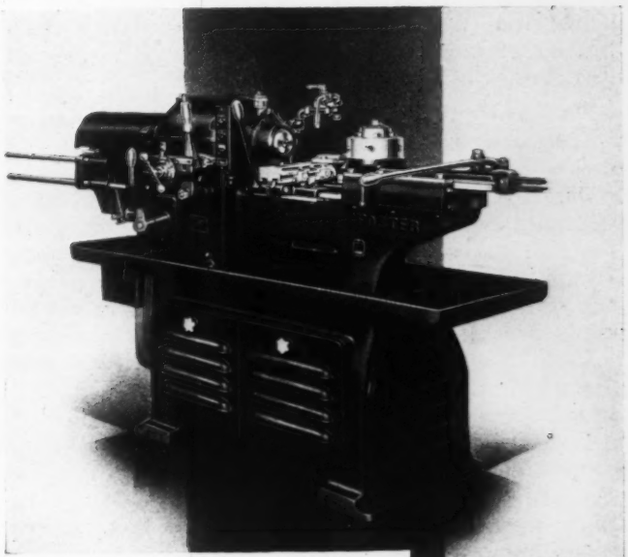


Fig. 1—Turret lathe with motor housed in well ventilated cabinet base

Engineers Discuss Electrification

By Guy Hubbard

MACHINERY builders recently learned facts about motors, control apparatus and electrical instruments which are of utmost importance to them and with which many of them had not been familiar. They saw developments unfolding in research laboratories which are very likely to have a decided effect upon machine design in the not far distant future. At the same time electrical engineers learned many things about the machinery industry, the importance of which they previously had not fully realized.

Such was the meeting of minds which took place during a four-day "Machine Tool Electrification Forum" sponsored by Westinghouse and attended by sixty engineers and other executives of leading machine tool builders. Sessions were devoted to: Motors; research developments; controls; applications; gearmotors; instruments; viewpoints of buyers and users; as well as to general mechanical-electrical problems. Lively discussion was promoted during these sessions by R. S. Elberty, T. I. Phillips, Bernard Lester, W. D. Turnbull and others who planned the program and in this way numerous valuable suggestions were made both by the machinery and the electrical men. For instance, it was brought out rather forcibly that machine tools in many cases deserve electrical equipment of finer finish,

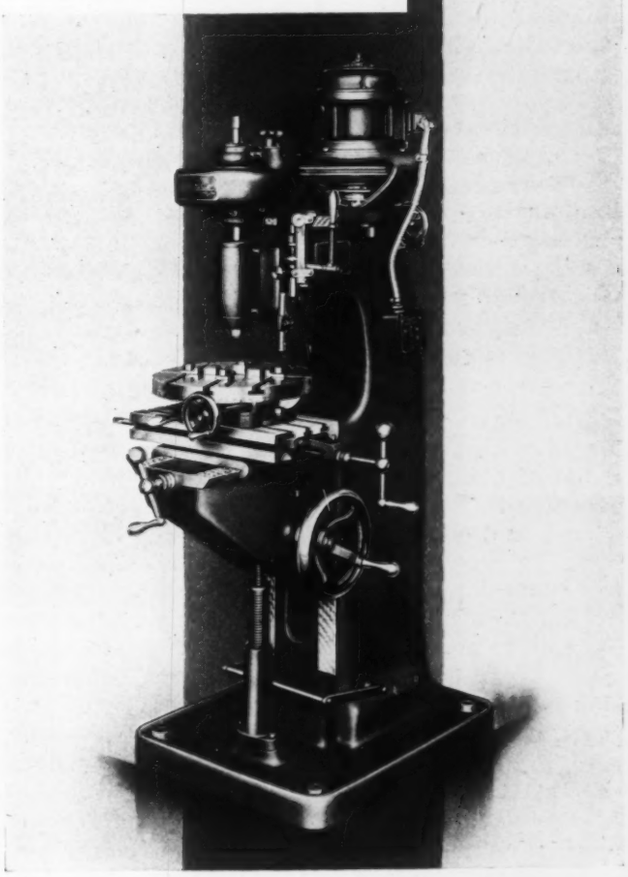


Fig. 2—Vertical flange-mounted motor driving a high speed spindle by direct V-belt connection

of "styled" design and of higher accuracy than that which is good enough for ordinary industrial purposes.

The present state of affairs in regard to appearance was illustrated by T. R. Lawson in his paper on alternating current motors for machine tools, this through a conversation which took place during the machine tool show last Fall. A motor salesman said to Mr. Lawson, "I want to show you one of the smoothest running grinders you ever saw. I sold the dynamically balanced motor for this job, but there's something lacking. See that streamline design of the whole machine? Now look at that motor sticking out there! What this customer wants is a motor to fit into those lines. Do we have it?" Upon being assured that such a motor was available, the immediate question then was, "How much?" In other words, the electrical industry is prepared to fulfill various special requirements of the machine tool industry, at an increased price over ordinary equipment, and in the last analysis the only question to be considered is, "How much extra will it cost?"

Motor dimensions emphasized by the machinery builders as requiring close limits are: Shaft diameter; distance from center of shaft to bottom of motor feet; and parallelism and concentricity of shaft—particularly in flange-mounted and shell-type motors. Such accuracy is especially important in motors which drive direct or through gear trains. It was brought out that while many individual manufacturers of motors adhere to close tolerances, there is need for further standardization throughout the industry considered as a whole. Both groups agreed that standardization on dynamic balance of motors also is needed. Before that can be accomplished, however, a standard method of testing must be established.

Safety Rules Are Important

Electrical engineers sounded a note of warning in regard to safety provisions in electrified tools, pointing out that in efforts to attain compactness in design there is a tendency to crowd wiring and controls. Standards in the electrical industry ordinarily are minimum ones and it is the policy of some electrical manufacturers to exceed these minimum standards by about fifty per cent to avoid trouble on difficult applications such as frequently are called for in conection with built-in control devices on machine tools, where moisture and dust are apt to be encountered. Admittedly there is a serious need for special standards for machine tool wiring but in the meantime machine tool builders are urged: First, to plan the wiring and location of all electrical equipment while the machine still is on the drawing board; second, to allow maximum rather than minimum factors of safety and third, to avoid crowding.

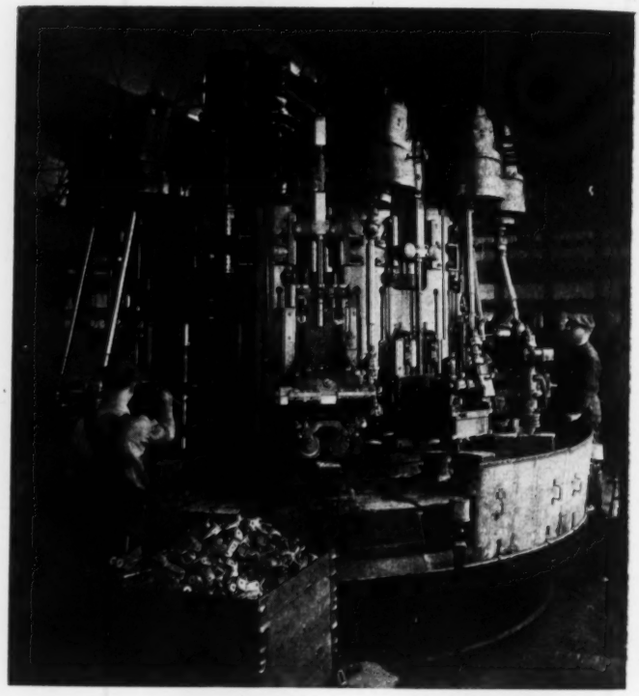


Fig. 3—Unit motor drives on this station-type machine give flexibility without complication

Bearing upon this matter of crowding, L. E. Markle said, "There is an increasing tendency today to manufacture machinery with the controllers built directly into the frames of the machines. Such designs present a good appearance but they certainly are representative of extreme cases of crowding apparatus into the smallest possible space. Electrical manufacturers from years of experience have established, through the National Electrical Manufacturers association, certain minimum dimensions to which it is well to give consideration. These represent distances between points of opposite polarity through and across clean dry surfaces. For voltages of 150 maximum this dimension is ⅛ inch through the air and ¼ inch across surfaces. For 300 volts it is ¼ inch through the air and ⅜ inch across surfaces. For 600 volts it is ⅜ inch through the air and ½ inch across surfaces. These statements should be qualified by adding that in cases where considerable moisture and dirt are likely to be present the dimensions must be increased. We have adopted the general practice of approximately doubling these dimensions in such cases."

In his paper on electrical controls for machine tools, George H. Garcelon pointed out that in an effort to have such elements as starters inconspicuous, some machine designers are demanding units of such small size that they are on the verge of becoming electrically and mechanically impractical. Mr. Garcelon said, "It is frequently best to enclose the control within the machine. We do not disagree on that point, neither do we question your demand for the smallest possible control. We plead only for adequate considera-

tion of electrical space requirements when you lay out your machine design."

He further stated, "The mechanically simplest types of control will be the best. Consider surrounding conditions such as presence of dust, moisture, oil and corrosive factors. How do the materials used react to these conditions? What is likely to happen when parts become worn and dirty? What unusual loads may occur? Will high or low voltages prevent good operation? How easily can worn or damaged parts be replaced? And finally, will a readily obtainable supply of repair parts be available throughout the entire life of the machine?"

Characterizing a pushbutton as "the electrical handle by which a machine is managed," R. J. Odum proceeded to outline briefly features of an ideal pushbutton for universal mounting. First, it should be rugged and simple in design, with generous contacts proof against corrosion and burning. Second, while it should occupy only a small amount of space, proper electrical clearances and mechanical strength of parts should be provided. Third, it should be designed for mounting either on a steel panel or in a cavity in a machine without requiring extra mounting details or insulation material and the electrician should be able to make wiring connections without disturbing its mounting. Fourth, its enclosure should be rugged, should discourage false operation, should allow ample space for wires and for adjustments and should be pleasing in appearance.

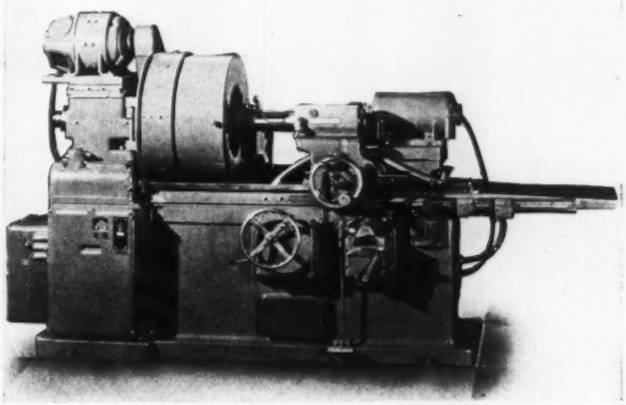
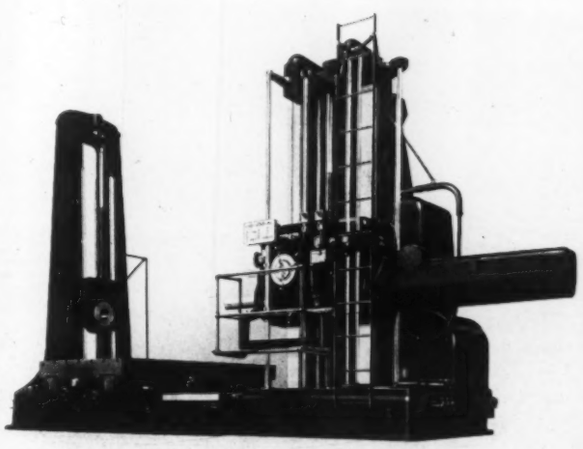


Fig. 4—Above—This internal grinder uses two motors, one driving chuck and other the spindle

Fig. 5—Below—Electrified horizontal boring machine with controls centralized in operator's cab



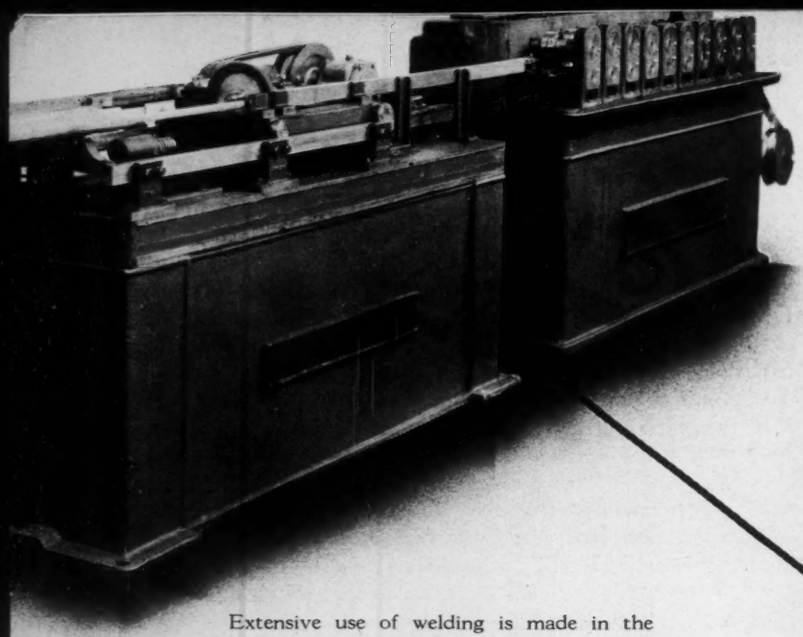
Considerable attention was focused upon the subject of the gearmotor which was cited as one of the significant mechanical-electrical developments during the depression, the possibilities of which have yet to be fully realized by designers of machinery. R. S. Marthens pointed out that electric motors ordinarily rotate at much higher speeds than does the majority of driven equipment and that the modern gearmotor takes care of both drive and reduction in one compact, neat appearing and efficient unit, which has few bearing parts, meets safety requirements, has long life and is low in cost. Standard gearmotors are now available ranging from fractional up to seventy-five horsepower, arranged for parallel or right angle drive, either horizontal or vertical, with wide choice of motor designs.

Advantages of Gearmotors

In determining whether or not gearmotors should be used, L. R. Botsai suggested that designers of machinery bear in mind that these units are an efficient means of power transmission; that their use enables substantial reduction to be made in size and weight of machines; that first cost and installation cost both are low; that they have few wearing parts thereby insuring low maintenance cost; and that the gearing is fully enclosed and correctly lubricated, insuring safety and long life. He added, "Consider the standard gearmotor as a complete machine to develop the required horsepower at the desired low speed, rather than as just a motor and gear unit."

Instrumentation of machinery is a development of which the possibilities have barely been scratched. Possibilities in this direction were set forth by B. R. Hill. He pointed out that complete integral instrumentation of an electrified machine is a comparatively simple matter and that from the instruments the operator can tell at a glance: Power consumption of the motors; speed and position of the various units; rate of feed; and the cutting speed. To get the most out of a production tool the operator should have this information constantly before his eyes.

"Usually," said Mr. Hill, "the cost of complete instrumentation will be only a small percentage of the total cost of a machine tool and it will soon pay for itself through better service of the tool under production conditions. Instrumentation is destined to be one of the most important contributions of the machine tool builders to those who use their products."



All attachments connect directly to the motor on Westinghouse food preparation unit, right. Pressure on two buttons drops out the beaters, while attachment is equally simple. An aircooled ⅛-horsepower motor powers the device.

Extensive use of welding is made in the fabrication of the Kane & Roach cold roll forming machine, above. The material is drawn from a coil, formed, tinned and sawed into lengths for handling as tubing.

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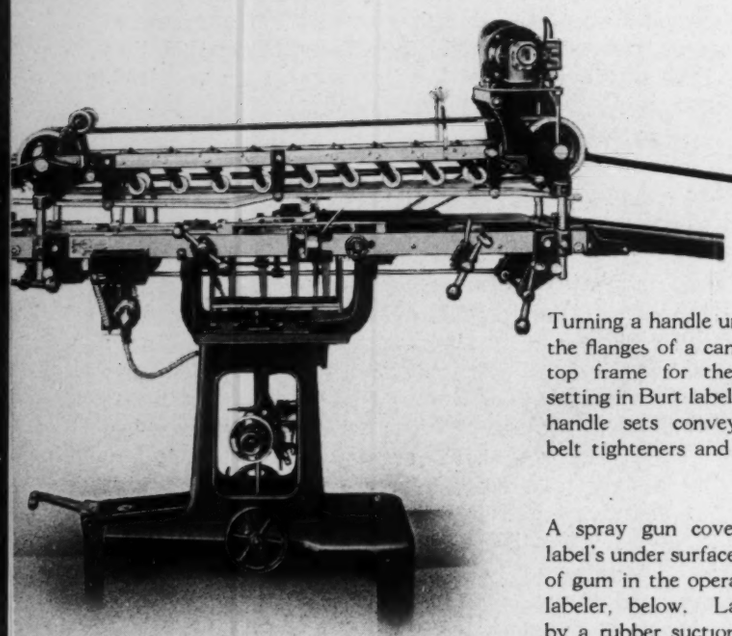
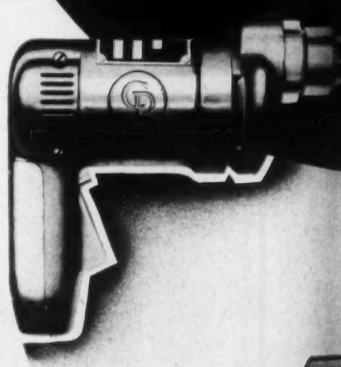
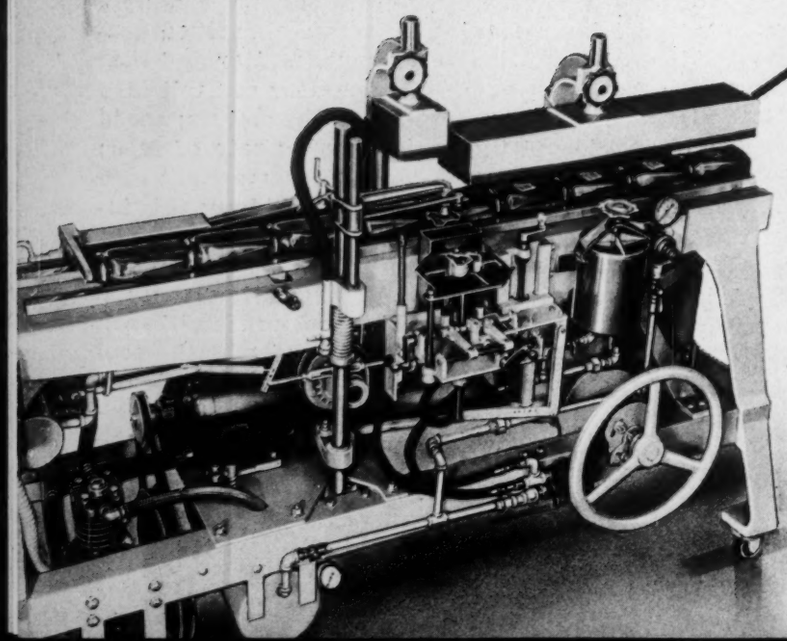


Turning a handle until two pins touch the flanges of a can sets the complete top frame for the correct diameter setting in Burt labeler, above. Another handle sets conveying belt, pulleys, belt tighteners and guide rod.

A spray gun covers all parts of a label's under surface with an even coat of gum in the operation of the White labeler, below. Labels are handled by a rubber suction cup while movement of bottles is automatically controlled





Sealed ball bearings mounted in steel inserts cast integral with the case are used in the Chicago universal electric drill, above. Switch is of the two-pole type with trigger and lock. Cooling air is directed over the gearcase onto the work.

A rheostat on the J & L automatic thread grinding machine, right, is graduated to correspond with graduations on the wheel-trueing device so that, as the wheel decreases in size, the rheostat may be changed to maintain proper peripheral speed.

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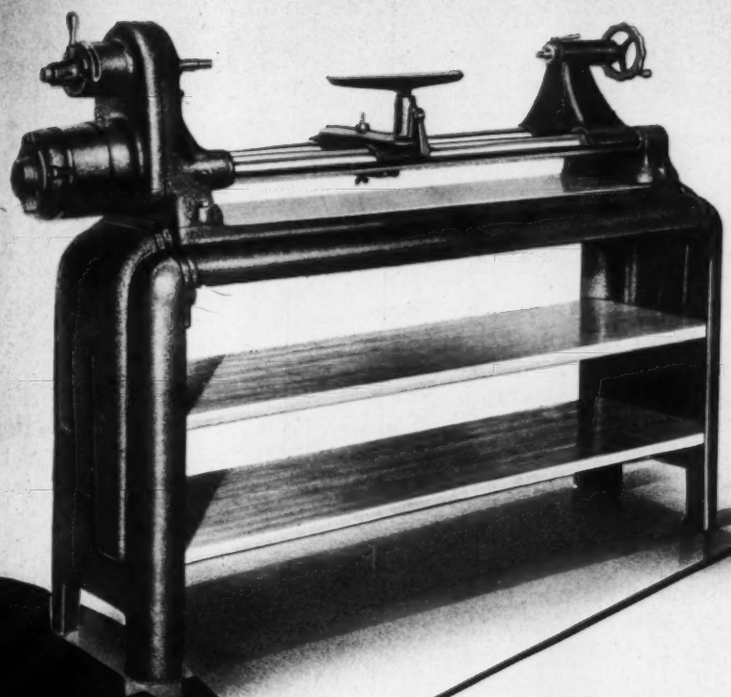
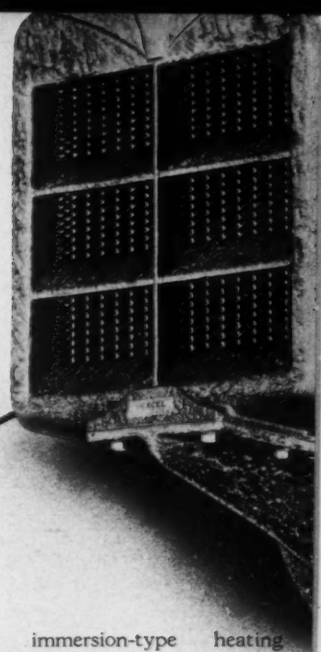
t Recent Machinery
int of Design.

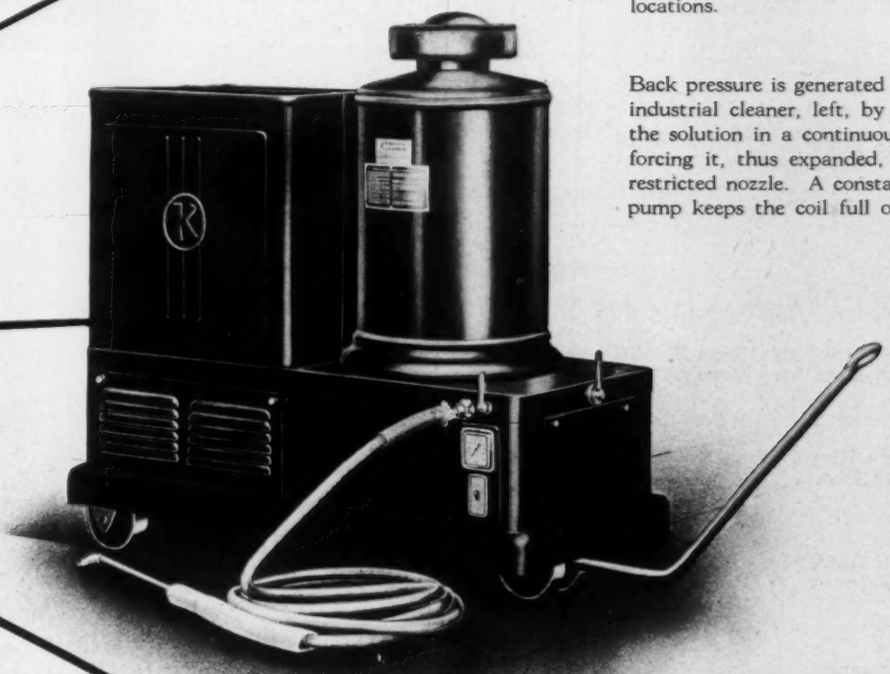
All parts of the infinitely variable speed drive on Yates-American woodworking lathe left, are fully enclosed and speed changes can be made without touching a belt or stopping the machine. The pedestal base and special finish are designed in keeping with the modern trend.

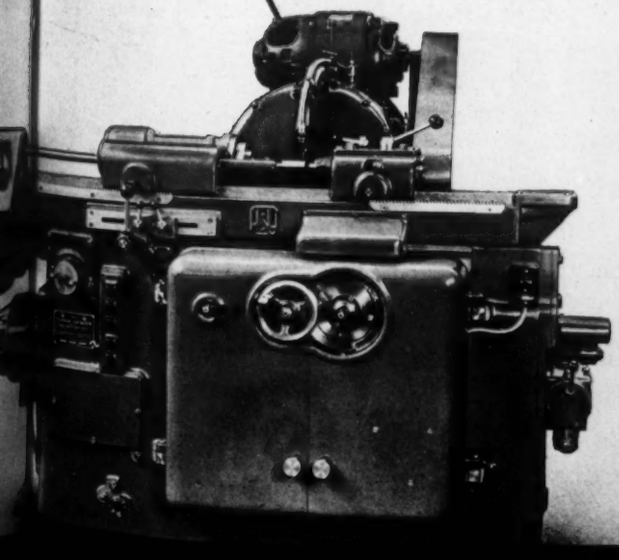




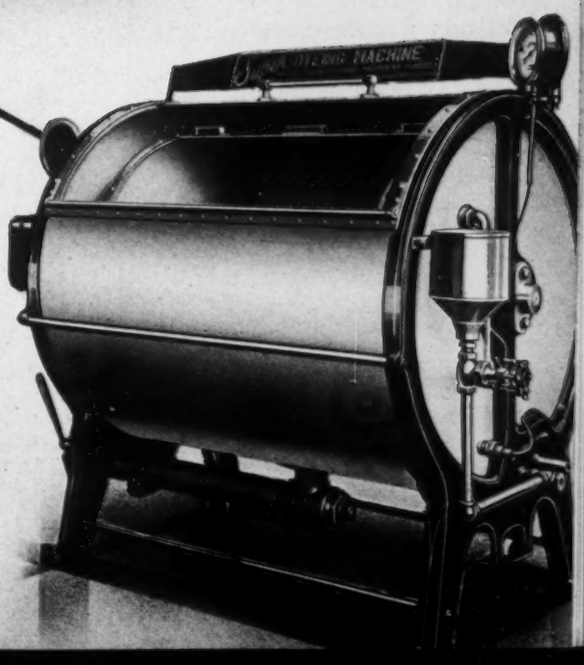
Electric immersion-type heating elements heat a nonfreezing liquid in Hexcel unit, above. Modernized outlines and crackle lacquer of antique gold fit the heater for a wide range of locations.

Back pressure is generated in Kerrick industrial cleaner, left, by expanding the solution in a continuous coil and forcing it, thus expanded, through a restricted nozzle. A constant volume pump keeps the coil full of solution





Spot welded construction is now used in the design of the Rochester dyeing machine, right, to aid in securing a smooth interior surface. A compact individual control unit is used, permitting a coasting period between reversals of the cylinder and thus eliminating vibrations.



New Machines Indicate Design Trends

Welding in its many forms is such a versatile tool that no designer can afford to overlook its possibilities. From this, it must not be accepted that welding is a cure-all; there are many parts fabricated more easily by other methods. However, welding is really just gaining its maturity. Developments are being made so quickly that the engineer planning the application of welding must constantly revise his concepts. One of the most recent developments is a process by which welding can be done at 700 degrees Fahr. In October, MACHINE DESIGN will publish a special insert in which future trends, latest developments and practical applications of welding will be presented.

Machines recently announced in addition to those on the preceding two pages include the following, arranged by fields of application:

Air Conditioning

Vertical Type Room Conditioner, York Ice Machinery Corp., York, Pa.

Brewery

Can Rinser, Karl Kiefer Machine Co., Cincinnati.

Cement

Air-Quenching Clinker Cooler, Allis-Chalmers Mfg. Co., Milwaukee.

Construction

Screening Equipment, Hendrick Mfg. Co., Carbondale, Pa.

Walking Dragline, Page Engineering Co., Chicago.

Utility Ditcher, Buckeye Traction Ditcher Co., Findlay, O.

Truck Operated Rock Crusher, Eagle Crusher Co., Galion, O.

Dairy

Unit Spray Drying and Reaction Chambers, Bowen Research Corp., Garwood, N. J.

Cold Filtering Device, Johnson & Johnson, New Brunswick, N. J.

Domestic

Automatic Water System, Decatur Pump Co., Decatur, Ill.

Juice Extractor, A. C. Gilbert Co., New Haven, Conn.

Under-Feed Stoker, Gray & Murdock Mfg. Co., Salt Lake City, Utah.

Anthracite Stoker, Anchor Stove & Range Co., New Albany, Ind.

Washing Machines, Holland Rieger Inc., Sandusky, O.

Hand Massage Machine, Allover Mfg. Co., Racine, Wis.

Food

Paddle Type Feeder, Sprout, Waldron & Co. Inc., Muncy, Pa.

Coffee Mill, Hobart Mfg. Co., Troy, O.

Foundry

Sand Preparation Unit, Link-Belt Co., Philadelphia.

Industrial

Press and Cutter, Flexo Machines, Chicago.

Steam Turbine, Dean Hill Pump Co., Anderson, Ind.

Cleaning Unit, Homestead Valve Mfg. Co., Coraopolis, Pa.

Centrifugal Dryer, Hanson-Van Winkle-Munning Co., Matawan, N. J.

Materials Handling

Bucket Loader, General Conveyor & Mfg. Co., St. Louis.

Metalworking

Two-Column Pushemall Press, Oilgear Co., Milwaukee.

Rotary Straightening Roll, Kane & Roach Inc., Syracuse, N. Y.

Iron Workers, Buffalo Forge Co., Buffalo, N. Y.

Lathe Grinder, Dumore Co., Racine, Wis.

Cut-Off Saw, Oliver Machinery Co., Grand Rapids, Mich.

Precision Bench Lathe, Hardinge Bros., Elmira, N. Y.

Packaging

Bar Wrapping Machine, Package Machinery Co., Springfield, Mass.

Can Filling Machine, Horix Mfg. Co., Pittsburgh.

Printing

Hydraulic Matrix Molding Press, R Hoe & Co. Inc., New York.

Restaurant

Table Type Dishwasher, Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.

Rubber

Power Operated Drum, National Rubber Machinery Co., Akron, O.

Textile

Full-Finished Hosiery Machine for Single Unit Stockings, Wildman Mfg. Co., Norristown, Pa.

Skein Soaking Machine, Johnson Engineering & Mfg. Co., Wilkes-Barre, Pa.

High Speed Rayon Slasher, Saco-Lowell Shops, Boston.

Rubber Covering Machine, H. H. Arnold Inc., Rockland, Mass.

Doubling and Folding Machine, Hermas Machine Co., Hawthorne, N. J.

Patent System Is Due for Change—the Sooner the Better!

OVER two million patents! Such is the record of output of the United States Patent Office since the inauguration of the present patent system one hundred years ago—in July, 1836. That all of these patents are not sound is indisputable; probably not more than ten per cent have possessed any commercial value or possibilities—and of this number the majority are open to the question of infringement and prior claims.

Could not the patent office exercise stricter control over the issuance of patents? This would eliminate many costly court cases—but the claim is that it can't be done! Perhaps it cannot under the present system, yet there's no reason why a system—even though basically good—should be considered above reproach. The millions of dollars at present spent in wrangling in court could surely be put to more remunerative use. Furthermore, the loss of time and delay in progress might well be reduced.

Let's hope we'll see the day soon when all patents are *sound* patents, and when infringement cases (a few of which may be considered as necessary evils) are handled by a single court of patent appeals, with court staffs thoroughly versed in the art.

It is up to the patents committee of the Science Advisory Board to press for the passage of satisfactory and equitable measures through Congress.

Far-Sighted Vision

CAN a really creative designer (the inventor type) visualize practical production problems? Do the two things conflict to the point of retardation?

No two companies, necessarily of the larger type, seem to have the same answer. In some organizations the designer, who may be brilliant yet narrow, is given full sway in his inventive capacity and is not expected to consider manufacturing problems; in others the design must be practical from the outset.

Design should not be stifled. But good design means, as one of its many factors, economy in production—and the best designers are those who have the ability to appreciate "the other fellow's problems" when laying out their ideas.

Professional Viewpoints

MACHINE DESIGN WELCOMES LETTERS SUITABLE FOR PUBLICATION

Let's Recognize the Designer

To the Editor:

REGARDING Paul Hoffman's article in your July issue on "Let's Recognize the Designer," this would never do! Imagine any concern advertising the worth of a good designer to the trade in general.

A good designer is a desirable thing to have, and, when acquired or developed, the idea is to cover him up as much as possible. In this way he is unknown to most everyone but himself and words from his mouth are greatly discounted. Even if he is loyal, it would not do to reimburse him much above the ordinary run of draftsmen for everyone knows that the concern is always losing money.

So keep him in fear of losing his position, and if he has no other contacts he will work like forty to keep the wolf from the door!

—E. H. F., *Chicago.*

Determines Radius of Gyration

To the Editor:

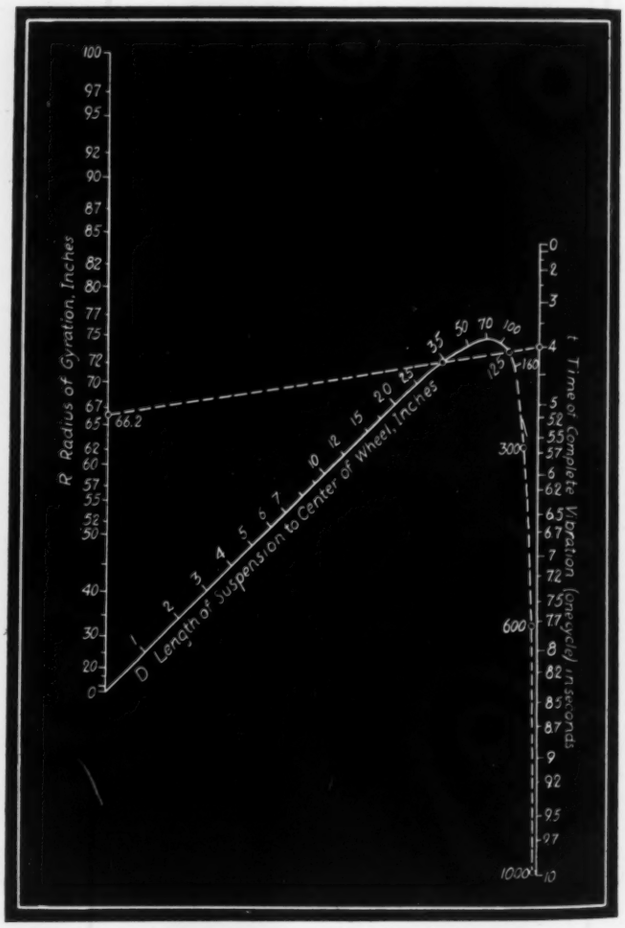
IN THE determination of the kinetic energy or "flywheel effect" of a rotating mass, the radius of gyration enters as a factor. Its value depends on the radial distribution of the mass, and it may be experimentally determined for a particular wheel by suspending it as a pendulum and timing its vibrations. This method has been described by J. S. Carpenter in the November, 1935, issue of MACHINE DESIGN, page 25, in his very practical article on "Determining the Effect of Rotating Masses." The formula is herewith derived, and a nomogram made for its graphical calculation by drawing a single line across three scales.

The time in seconds of one complete vibration (forward and back, or one cycle) of a compound pendulum of K inches radius of gyration with respect to its axis of suspension, and D inches length from this axis to the center of the gravity of the pendulum is:

$$t = 2\pi\sqrt{K^2/Dg}$$

In this, g equals 386.4 inches per sec. per sec., the acceleration due to gravity. This equation is true for small vibrations, in which the circular arc described does not sensibly depart from the theoretically isochronous cycloid.

Also the radius of gyration K of the mass, in terms of the radius of gyration R about a parallel axis through the center of gravity of the mass, if D is the distance between the two axes


R Radius of Gyration, Inches
D Length of Suspension to Center of Wheel, Inches
t Time of Complete Vibration (one cycle) in seconds
66.2

Value of radius of gyration depends on the radial distribution of the mass as shown by this nomogram

(all in inches) is given by:

$$K^2 = R^2 + D^2$$

Eliminating K^2 between these equations, and solving for R^2, we have

$$R^2 = (386.4\ t^2D/4\pi^2) - D^2$$

and reducing

$$R^2 = 9.82\ t^2D - D^2$$

From this, if t and D are observed, then R, the desired radius of gyration of the wheel revolving about its own axis, may be calculated. Therefore, the gear or flywheel, etc. is to be hung by knife edges, as suggested in *Fig.* 4 in the article referred to, or the knife edges may be eccentrically mounted on the wheel itself, the distance D measured, and the time of the complete oscillation determined by summation over a considerable time, while it is vibrating through a small arc.

The last equation is a quadratic, and when solved for D yields

$$D = kt^2/2 \pm \sqrt{(kt^2/2)^2 - R^2}$$

in which K is equal to 9.82. (In the nomogram this has been taken as 10.) This shows that for each value of t and R, there will be two distances D, one for each sign before the radical; except when the radical equals zero, and for this the secant will be tangent. In the nomogram, the curved scale has been continued in dotted lines beyond useful values to illustrate this point. The secant cutting the outer scales at the requisite values cuts this curved intermediate scale *twice,* though the plus values on the dotted portion are impractically high values of D. The secant through $t = 4$ seconds and $R = 80$ inches is tangent to the curve at $D = 80$ inches. The dotted secant shows that a flywheel suspended 35 (or 125) inches from its center, and making a complete vibration in 4 seconds, has a radius of gyration of 66.2 inches.

—Carl P. Nachod, *vice president,*
Nachod & U. S. Signal Co. Inc.

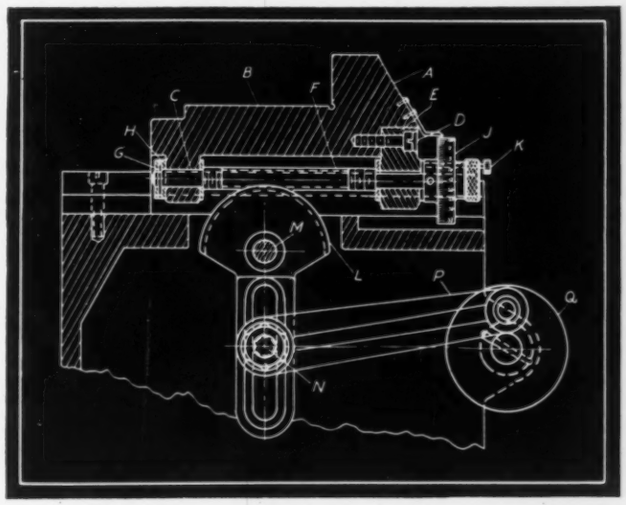
Secures Adjustable Motion

To the Editor:

In a low priced horizontal, small-type drilling machine it was necessary to obtain an adjustable reciprocating motion so that both the feed stroke and the position of the table could be adjusted with reference to the fixed drill spindle.

To obtain this arrangement, the construction shown in the accompanying drawing was evolved.

Slide *A* was of the usual square gibbed type. Upon this slide at *B* the fixture for drilling was clamped. As will be noted, the slide is of the hollow arch type, in the center of which lug *C* was cast on the front end. Rear lug *D* was inserted into milled-out slot *E,* and held in place by the screw shown. This was done for ease in assembling the right hand threaded worm shaft *F*. This shaft was held in place by the shoulders as shown and by collar *G* which is cross pinned at *H*. At the rear end of the shaft micrometer dial *J* is fastened by another cross pin. After adjustment is made of slide *A,* dial *J* was locked in place by screw *K*. This prevented worm shaft



Mechanism gives adjustable reciprocating motion in horizontal small-type drilling machine

F from turning while in operation of feeding the work into the drill.

Wormwheel sector *L* forms the reciprocating driver, and was pivoted as shown at *M*. The lower part of the sector formed a slotted lever as indicated, into which there was clamped at any desired position a stud, *N,* upon which rotated connecting lever *P*. This lever in turn connected with eccentric *Q,* which, operating from another wormwheel, delivered the feed rate to slide *A*.

—John A. Honegger,
New York

Why Use a Metric System?

To the Editor:

In the June issue of Machine Design Lloyd A. Whittaker requests American ball bearing manufacturers to change their standards from metric to English sizes. It might interest him, and perhaps others of your readers, to learn that, strangely enough, standard stock ball bearings having outside dimensions in English sizes are obtainable from "Kugelfischer", Schweinfurt, Germany.

—Frederick Franz,
New Haven, Conn.

MEN of MACHINES

RETIREMENT of Francis Hodgkinson after four decades of outstanding engineering service with Westinghouse Electric & Mfg. Co. recently was marked by a farewell dinner attended by one hundred and sixty fellow employees. On this occasion a watch was presented to Mr. Hodgkinson as a token of esteem.

Born, educated and apprenticed in England, Francis Hodgkinson in 1885 became associated with Sir Charles A. Parsons during development of the reaction steam turbine. After interesting naval and engineering experience in Chili and Peru, Mr. Hodgkinson joined the staff of George Westinghouse in 1896.

He initiated building of turbines by the Westinghouse company, becoming chief engineer in 1916 and consulting mechanical engineer in 1926.

FRANCIS HODGKINSON

• • •

MODERN technical developments in many instances are bringing greater opportunities for success to mechanical engineers. A case in point is the recent promotion of D. D. Wile to the position of chief engineer of refrigeration and air conditioning with Detroit Lubricator Co.

A native of Louisville, Mr. Wile became a tool maker before going to college and worked his way through the engineering school of the University of Kentucky by making inventor's models. Following a period with Pierce Arrow Motor Co., he entered the laboratories of American Radiator Co., Buffalo, in 1924 and specialized in refrigeration research. In 1927 he was transferred to Detroit Lubricator Co. to take charge of research in the accessories laboratory.

D. D. WILE

• • •

AS VICE president of the American Gear Manufacturers association, H. H. Kerr again demonstrates his willingness to devote time and attention to the broad problems of industry. This spirit previously has been shown in various ways, such as through his able work as chairman of the code authority for the gear industry, as employers' representative on the Massachusetts adjustment board of N.R.A. and as president of the Employers association of eastern Massachusetts.

Mr. Kerr is a native of Boston. Beginning his career as a structural steel worker, he went from the Fore River shipyards to one of the pioneer automobile plants in Boston. With that practical experience he entered Boston Gear Works, North Quincy, Mass., in 1906 as a workman in the department manu-

H. H. KERR

facturing steering devices. Rising steadily from the ranks, he was elected vice president and assistant treasurer when the company was incorporated in 1924 and was made president in 1929.

At the present time Mr. Kerr also is serving as president of the Boston Branch of the National Metal Trades association.

♦ ♦ ♦

L. RAY BUCKENDALE has been appointed vice president in charge of engineering of Timken-Detroit Axle Co., Detroit. He had been with the engineering department of the company since 1911, his present promotion being from the position of executive engineer.

♦ ♦ ♦

H. C. MANN, senior materials engineer, Watertown Arsenal, Watertown, Mass., has been awarded the 1936 Charles B. Dudley medal as the author of the most outstanding paper presented at the annual meeting of the American Society for Testing Materials.

♦ ♦ ♦

L. W. GROTHAUS was recently elected vice president of Allis-Chalmers Mfg. Co., Milwaukee. Mr. Grothaus, who has a broad background of drafting and engineering experience gained during his thirty-two years of experience with the company, served as a member of the War Industries staff during the war.

♦ ♦ ♦

E. J. WOOD, formerly with Mesta Machine Co., has been appointed chief engineer of Goodman Mfg. Co., Chicago.

♦ ♦ ♦

W. H. KORTUM has been appointed chief engineer, Horton Mfg. Co., Fort Wayne, Ind. Mr. Kortum is an authority on design of laundry machinery for home use. He has been with this company for seventeen years.

♦ ♦ ♦

J. A. BLUNT has been appointed chief mechanical engineer of American Locomotive Co., with headquarters at Schenectady, N. Y.

♦ ♦ ♦

H. P. HAMMOND of Brooklyn Polytechnic Institute was elected president of the Society of the Promotion of Engineering Education at the recent annual convention held at University of Wisconsin.

♦ ♦ ♦

DR. ZAY JEFFRIES, noted metallurgist, who for a number of years has served as president of the Carboloy Co., has been made chairman of the board of directors. W. G. ROBBINS, formerly vice president and general sales manager, has been elected president. These promotions were occasioned by the recent resignation of P. R. MALLORY as chairman of the board.

♦ ♦ ♦

A. FRANCIS ARCIER, chief engineer, Waco Aircraft Co., has been elected a fellow of the Royal Aeronautical Society of England.

♦ ♦ ♦

M. MALETZ, formerly in charge of the engineering department of Perfection Gear Co., has joined Fairbanks, Morse & Co., as designing engineer in the diesel engineering division, Beloit works.

♦ ♦ ♦

I. A. TAYLOR, formerly chief engineer of Riley Stoker Corp., Worcester, Mass., has joined the engineering staff of the Norton Co., with headquarters in the same city.

♦ ♦ ♦

DIMITRY NICONOFF, J. G. DONALDSON and L. H. BERKELHAMMER have been added to the technical staff of Battelle Memorial Institute, Columbus, O., being assigned respectively to the process metallurgy, chemical and ceramics divisions.

♦ ♦ ♦

DEAN HERMAN SCHNEIDER of the University of Cincinnati was awarded the Lamme medal for engineering achievement, during the recent meeting of the Society for Promotion of Engineering Education at Madison, Wis.

♦ ♦ ♦

P. K. REED, who for many years was chief engineer of R. H. Beaumont Co., and more recently president of Atlas Conveyor Co., has joined C. O. Bartlett & Snow Co., Cleveland, with whom he will be engaged in engineering and sales work.

♦ ♦ ♦

R. K. SUPER has been appointed chief engineer of Linderman Devices Inc., Detroit. He was for the past six years in charge of brake development with Mack International Motor Co.

♦ ♦ ♦

DUDLEY P. CRAIG has resigned as associate professor of mechanical engineering Purdue University, to become head of the mechanical engineering department, Colorado State College of Agriculture and Mechanic Arts, Fort Collins, Colo.

♦ ♦ ♦

DR. LEO H. BAEKELAND, founder and president of the Bakelite Corp., New York, has been elected an honorary member of the Royal Society of Edinburgh, Scotland.

♦ ♦ ♦

EDWIN J. SCHWANHAUSSER, manager of the Buffalo works, Worthington Pump & Machinery Corp., has been elected president of the Buffalo Chamber of Commerce. Mr. Schwanhausser is an engineering graduate of Stevens Institute of Technology.

♦ ♦ ♦

A. M. MACCUTCHEON, engineering vice president, Reliance Electric & Manufacturing Co., Cleveland, was elected president of American Institute of Electrical Engineers at the recent convention held at Pasadena, Calif., taking office on August 1, 1936.

♦ ♦ ♦

A. C. FIELDNER has been nominated for president of American Society for Testing Materials. Mr. Fieldner, who is chief engineer, Experiment Stations division, U. S. Bureau of Mines, Washington, graduated in chemical engineering at Ohio State University in 1906. He is a specialist on gas investigation and during the was was in charge of the Gas Mask section, Chemical Warfare service, with rank of major. Since then he has done much toward perfecting industrial gas masks.

Obituaries

ALBERTIS C. TAYLOR, vice president, Taylor-Winfield Corp., Warren, O., died recently in that city at the age of fifty-seven. Mr. Taylor, who was one of the pioneers in the development of electric welding machines, the spot welder in particular, began work when he was sixteen, as a machinist's apprentice with Trumbull Mfg. Co. in Warren. Upon completion of his apprenticeship he went to work for Packard Automobile Co., which at that time was located in Warren.

Later he joined the Winfield Mfg. Co., which through mergers with the Taylor Welder Co. and the Winfield Electric Welding Machine Co., eventually developed into the Taylor-Winfield Corp. Prior to his retirement from active business, Mr. Taylor was the president of the corporation.

Noteworthy Patents

APPLICATION of a solenoid to accomplish automatic winding of a clock is the main feature of an invention by Joseph Borti, assignor to Phinney-Walker Co. Inc., New York. *Fig.* 1 is a general view of the entire mechanism, including solenoid *A*, which is mounted and normally insulated from the movement plate *B*. The movement itself is similar to that of the ordinary spring-driven clock, except that power is stored up in the short tension coil spring *C* instead of in the conventional long spiral spring. Due to the shortness of spring *C* it requires frequent retensioning, which is the function of the solenoid.

Action is as follows: When mainspring *C* is giving up its tension it gradually pulls lever *D* upward, thereby driving the movement through pawl *O* and ratchet *P*. At the same time core *F* is gradually withdrawn from the solenoid *A*, until lever *G*—being pulled upward by hook *H*—snaps "past center" as its spring *R* crosses the centerline of pivot *Q*. Pin *J* in core *F* is insulated, but pin *K* is not, and as soon as this snap-action brings lever *G* against pin *K*, a circuit is established from the frame of the clock, through lever *G* to the core *F*, thence from spring commutator *L* to the bore of the solenoid and in turn through the solenoid winding. This energizes the solenoid and core *F* is drawn into the bore, which pulls down lever *D*. This retensions main spring *C*—in other words, "winds the clock." It will be noted that reversal of the action of the works is prevented by pawl *M* in ratchet *N*.

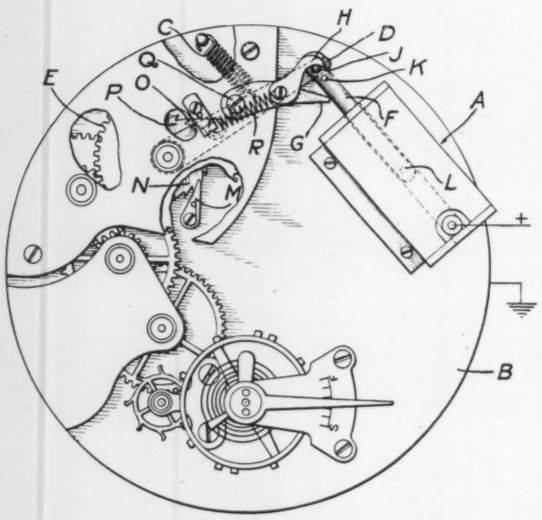


Fig. 1—*Intermittently acting solenoid drives clock by storing energy in a short coil spring*

Action of the solenoid continues until lever *G*, pushed by contact pin *K*, again snaps past the center of pivot *Q*. This breaks the contact, brings hook *H* against insulated pin *J* again, and mainspring *C*, recharged with power, picks up the load of running the clock.

The "rewinding cycle" is almost instantaneous and through the relatively long stroke of the solenoid, sufficient energy is stored in spring *C* to keep the clock running for a considerable period of time, thereby tiding over any ordinary interruptions in the electrical supply.

This patent is identified by No. 2,041,395.

AN INTERESTING modification of the paddle wheel is embodied in the invention of Alberto Zegers, illustrated by *Fig.* 2. In this illustration, *A* is a hollow streamlined casing which is revolved about its own axis. Within this casing, but mounted off center to it on eccentric arm *B* on adjustable shaft *C* is a cage *D*. This cage carries a number of curved vanes *E* which

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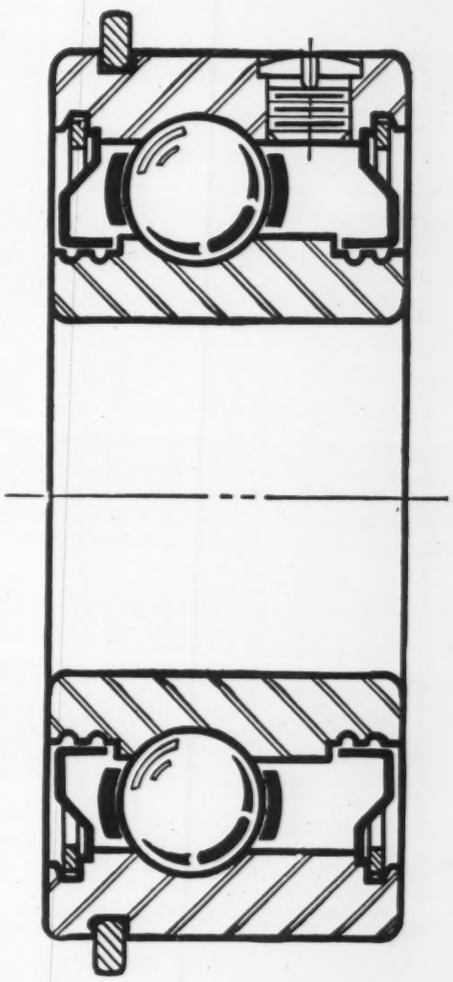

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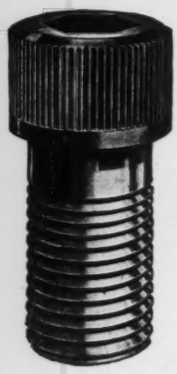

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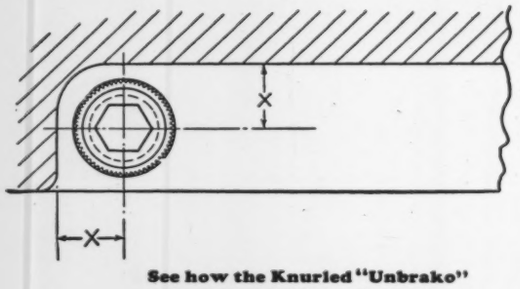

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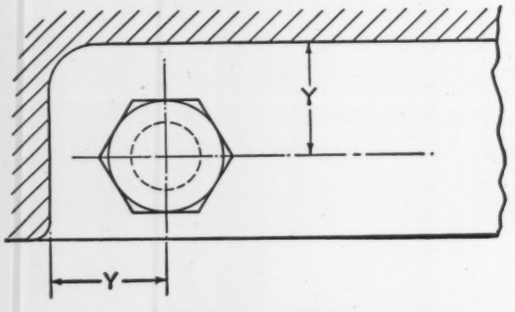

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are pivoted to it by means of wrist pins *F*. These vanes pass out through the periphery of the casing. Hence, at that point (*H* in *Fig.* 2) they exert maximum propelling action. From that point on they rapidly withdraw within the casing, until at the point where cage *D* and periphery of casing *A* are furthest apart (that is, at *J* when the vane has traveled 180 degrees) the end of the vane is flush with the periphery of the casing and exerts no propelling action. Then from point *J* on toward point *H* the vane begins to extend itself, gradually at first but rapidly during the final 45 degrees, thereby gaining definite propelling action, particularly during the final 45 degrees.

A point brought out in the patent is that this paddle wheel is run fully submerged, and by changing the location of eccentric arm *B* its propelling action can be reversed without changing the direction of rotation. Furthermore, the

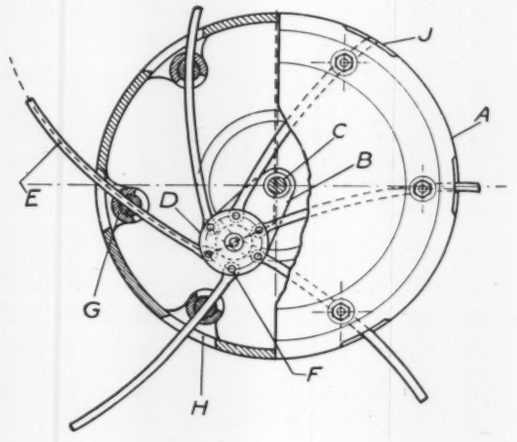

Fig. 2—Paddle wheel with retracting vanes exerts propelling action in any direction desired

vanes can be regulated to give the most effective propelling action. It also is brought out that when designed as a propeller for aircraft, the device can be set to give lifting action as well as forward or backward propelling action. Possible application of the device as the impeller of a centrifugal pump and the runner of a hydraulic turbine are mentioned.

It is suggested that the wheel can be used not only as a propulsion means but also as a means for turning and otherwise steering a ship, either forward or backward. It also is pointed out by the inventor that when applied to any of these purposes, the design of the wheel is such that outward projection of the blades diminishes rapidly when the boat "pushing zone" has been passed. This is said to be an important advantage of this over ordinary impellers.

This patent, which is identified by No. 2,041,-103, is assigned to Comunidad "Propulsor Chile," Santiaga, Chile.

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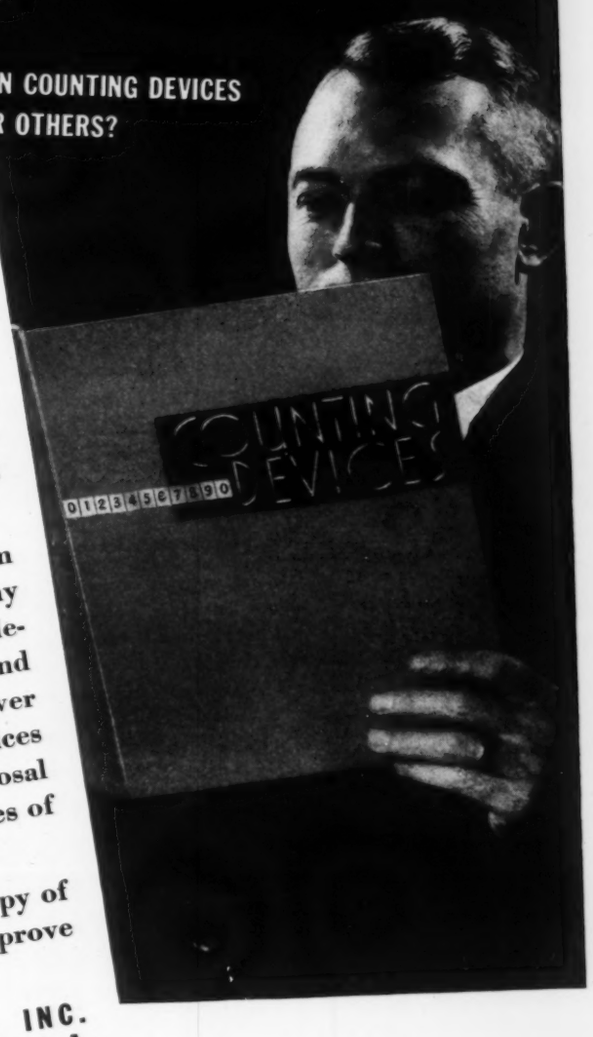

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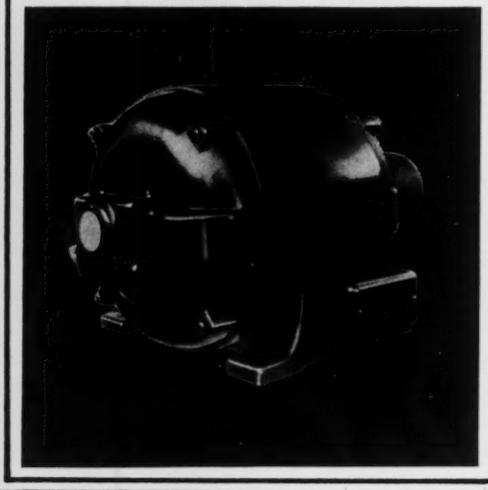
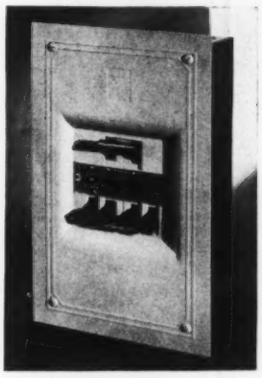


NEW Materials and Parts

Multibreaker Load Center Announced

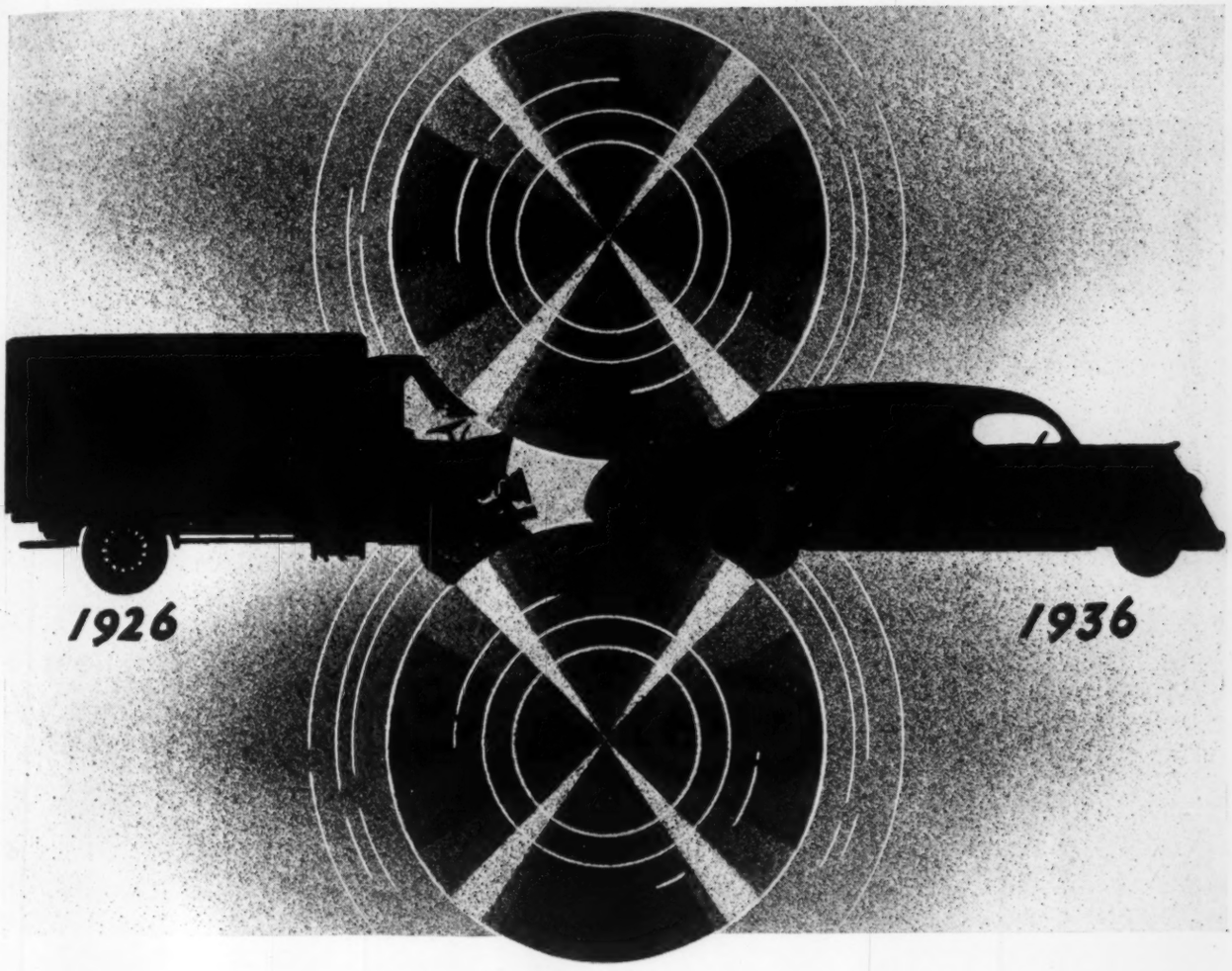
AS A SUBSTITUTE for the conventional 115/230 volt alternating current entrance and branch circuit protective equipment, a small multibreaker load center is being simultaneously announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and Square D Co., Detroit. The control, shown herewith, hinge mounted in a cabinet, consists of one or more small but effective automatic circuit breakers grouped in a sealed molded housing and each capable of interrupting 5000 amperes at 115 volts alternating current. Approved as service equipment complete with the cabinet, the load centers are provided with solid mains up to 70



One or more small automatic circuit breakers grouped in a sealed housing make up multibreaker load center

amperes and for 2-wire 115 volt or 3-wire 115/230 volts alternating current solid neutral service. The load centers are manufactured with varying numbers of circuits and circuit ratings to suit all ordinary demands. The branch circuit breakers are provided in ratings from 15 to 35 amperes. Only line and branch load terminals are exposed inside of the metal cabinet, all other connections being sealed within the circuit breaker housings. Main terminals are protected by insulating covers removable for wiring during installation.

The operation of the breakers in the load center is similar to that of larger and more costly breakers. The operating handle has the usual toggle action. When overloads or short circuits occur, the bimetallic element deflects, releasing the contact bar and the contacts separate. This provides a quick-break action. The operating



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from machinery of every kind

Compare this year's truck with its predecessor of ten years ago. Its weight, price and cost of operation have been radically reduced, with no impairment of safety. In fact it is more dependable, more enduring than ever before. Among the materials that have played an important role in this striking transformation are the Nickel Alloy Steels. Through a partnership with Nickel, the simple steels of yesterday have been rendered tougher and stronger—more highly resistant to shock, stress, fatigue, abrasion and wear. Their greater strength-to-weight ratio offers every manufacturer the opportunity to cut down power consumption and replacement costs. Our experience in the application of Nickel to industrial problems is at your disposal. Send for List "A" of available publications on Nickel and its alloys.

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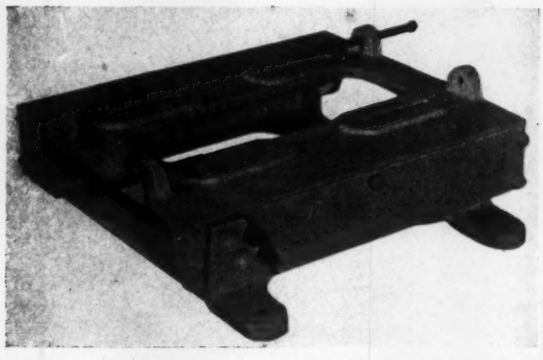
handle automatically indicates tripped position. If the overload is of momentary nature, or if a severe overload or short circuit has been removed, the breaker may be reset and the circuit closed. Should the breaker be reclosed against a continuing overload or short circuit, it will immediately trip again.

Resilient Motor Bases Introduced

A FLOATING platform suspended by resilient balls made of high grade rubber set into recesses between parallel flanges is used to insulate against the transmission of noise and vibration between electric motors or machinery



Resilient balls of high grade rubber are employed to give a floating action to this motor base

and building structure in the new base of W. D. Fabling Co., 2043 Sacramento street, Los Angeles. The number of balls can be adjusted to suit the weight and conditions under which the base operates.

The motor support platform of the base, shown herewith, is slotted and has adjusting screws for belt adjustment. It is designed to fit NEMA standardized motor dimensions and in universal base designs for fractional horsepower motors. The resilient balls are protected from oil. Special design bases can be supplied, and they can be furnished for any reasonable weight or frequency of vibration, or where equipment is heavier on one end than on the other.

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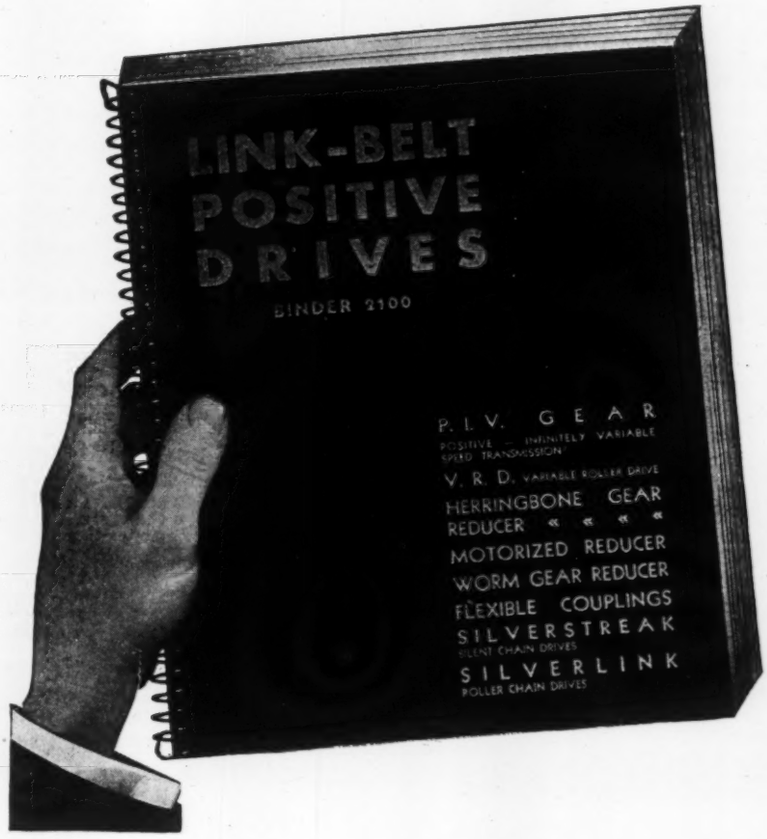

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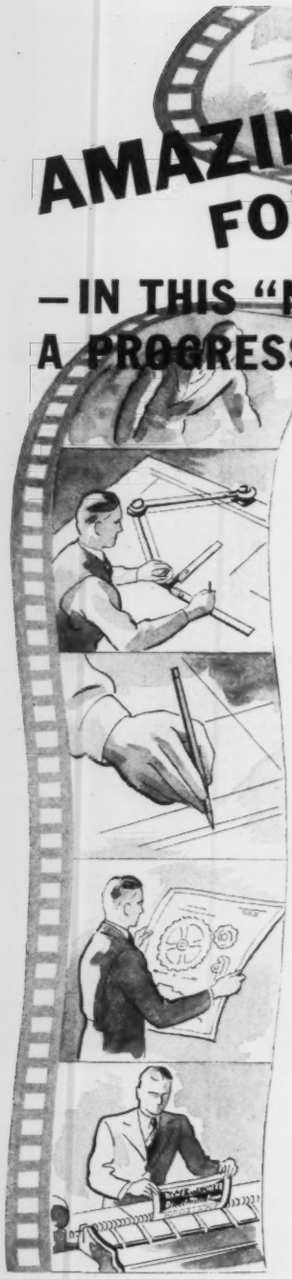

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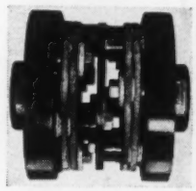
wrapped in aluminum foil. This method of testing greases and packaging the bearings is a result of investigation by the company's research department with a view to safeguarding against the difficulties resulting from the oxidation and premature hardening of ordinary greases.

Couplings Have Extra Flexibility

FLEXIBLE couplings designed for use where the driver and driven units are not on the same base and where there is a possibility of considerable angular shaft misalignments, or where the drives are subjected to a great deal of vibration and shock are now being marketed by Smith Power Transmission Co., 1213 West Third street, Cleveland. Extra flexibility is



New couplings are designed for installations where there is possibility of considerable shaft misalignment

claimed for these new units by virtue of the fact that they incorporate two separate flexible units, each of which is flexible by itself. The center section is constructed of a steel disk with spacers pressed into it, providing a solid center driving section which is rigidly bolted to the driving flanges through the two flexible sections. This construction makes the coupling reversible and eliminates loose parts, so that it may operate in any position. It is completely balanced and is light. It may be used for high or load speed transmission.

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HIGH strength and high electrical conductivity are combined in the new heat-treatable copper-base alloy now being offered by Beryllium Corp. of Penna., Reading, Pa. The castings are said to have the following properties for standard test bars: Electrical conductivity, 50 per cent; tensile strength, 95,000 pounds per square inch; elastic limit, 85,000 pounds per square inch; elongation in 2 inches, 5 to 8 per cent; hardness, 96-98 Rockwell B.

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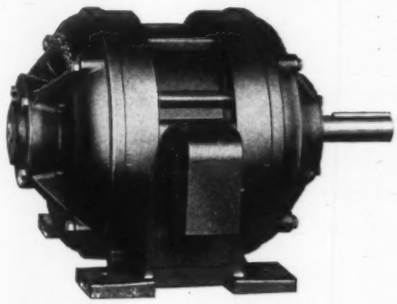

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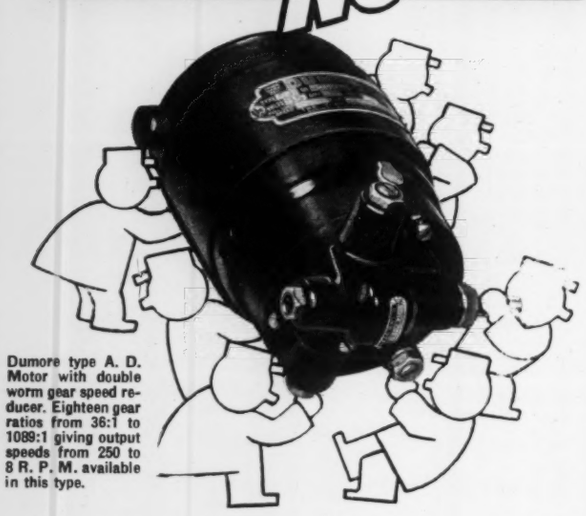

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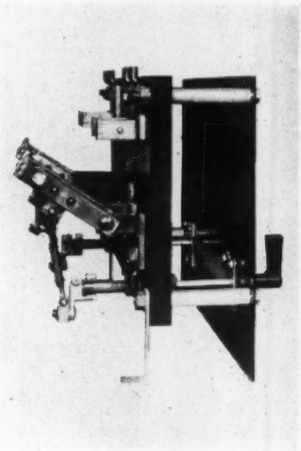
Develops New Discharge Switches

MANUALLY-OPERATED field discharge switches for motor and generator field circuits, which are dead-front and mounted in back of the board, have been announced by General Electric Co., Schenectady, N. Y. The new switch, shown herewith, type LF-23, is rated 250 volts direct current, 100 and 200 amperes only, double-pole, single-throw. Double-throw switches are made up of two single-throw switches with mechanical interlock to prevent closing both throws at one time. The operating handle and escutcheon are similar to those of the type SB-1 control switch and will match the appearance of other control and instrument switches on the switchboard. The direct-operating mechanism and compact construction allow minimum panel front installation space. Torque-type contact with laminated blades provided with embossed line pressure contacts are used to assure efficient contact and low heating.



Double-throw switches have a mechanical interlock which prevents closing both throws at the same time

Graphite Is Bound into Packing

GENERAL all-service plastic packing with a new antifrictional dry-graphite lubrication has been announced by Crane Packing Co., 1813A Cuyler avenue, Chicago. This product, which bears the name Super-Seal, is said to provide a permanent antifrictional seal. It is resilient and there is no tendency to harden or dry out. It flows readily under gland pressure

CARNEGIE-ILLINOIS *Alloy Steels*

. . . made to fit your jobs

THE METALLOGRAPHIST FORECASTS PERFORMANCE

One important factor in determining how a particular alloy steel will function is the microscopic study of its crystalline structure. From each heat of Carnegie-Illinois Alloy Steel, samples are taken for such studies.

TODAY our metallurgists and skilled operating men, working hand in hand with industrial engineers and designers, find their greatest satisfaction in creative development. Matching a steel with the special need for it to give you the most for your steel dollar is a continually stimulating force. In our plants "custom made" has just as definite a meaning as in the most exclusive tailoring establishments.

Whether you need steel to resist corrosion—steel that combines high strength with light weight—steel that must be strong at low temperatures or strong at high ones—or that has special immunity to shock or abrasion—whatever your needs, we can furnish you dependable Alloy Steels of the correct physical, metallurgical and chemical properties. Not once, but again and again.

For in Carnegie-Illinois Alloy Steels these vital properties are maintained *consistently uniform* from bar to bar, from heat to heat, from shipment to shipment.

Uniformity, gained by scientific control of every step in manufacture, is the distinguishing mark of Carnegie-Illinois Steels. It assures you consistently economical fabrication—guarantees the dependable performance of your product in service.

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh — *Chicago*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

DESIGN—Engineered by experienced men, with many years of training in meeting the problems of GEAR manufacturing.

MATERIALS—Selected after a most careful study of the requirements of job to be done.

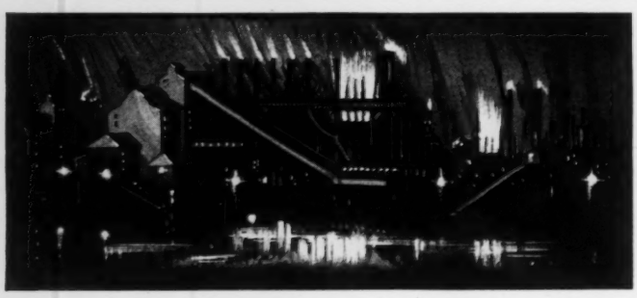
PLANT—Manufactured in a most completely equipped and versatile GEAR producing plant.

TYPE OF GEAR—We make all types of gears—and have had almost 50 years' experience in GEAR cutting and generating.

TESTING—Our testing department is competently manned, with the latest testing devices.

RESULT—Smooth meshing gears—yet very powerful—minimizing your production problem.

D. O. JAMES MANUFACTURING COMPANY
1120 W. MONROE STREET • CHICAGO, ILLINOIS
ESTABLISHED 1888



FOR 79 YEARS ROPER PUMPS
have served industry

Over three-quarters of a century of experience . . . long enough to learn the intricacies of manufacture . . . but not long enough to lose the spirit of progress which constantly seeks greater efficiency.

Roper Pumps are quality built . . . they serve and serve well.

Figure 1850 herewith illustrated is a Roper Non-Pulsating Coolant Pump for handling cutting compounds and lubricating fluids on metal working machines. Ample power to supply the deepest bores and cuts . . . guaranteed not to lose prime . . . high or low pressure, delivering 1 to 20 G.P.M.

Write for all the facts in Bulletin No. R4MD

ROPER PUMPS

GEO. D. ROPER CORP., ROCKFORD, ILL.

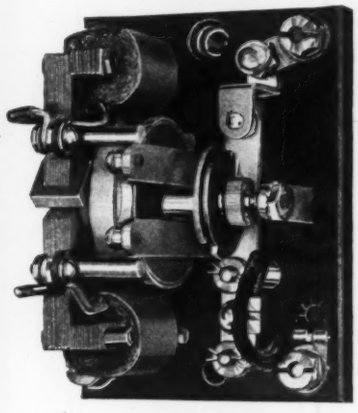
which makes it easy to adapt to smaller or larger packing spaces.

The packing is composed basically of extremely fine particles of a new alloy. Special high temperature binder, containing pure flake graphite, completely covers each particle of this alloy and each strand of long fiber asbestos. The packing is processed for even distribution of the binder and for resistance to high temperatures.

Six styles and six forms of the packing are available. Sizes announced are: Valve stem, round, 3/16, ¼ and 5/16 inch; spiral form, rectangular, in steps of 1/16-inch from ¼ to 1¼ inches inclusive; and coil form, round, in eleven sizes from ⅜ to 1 inch.

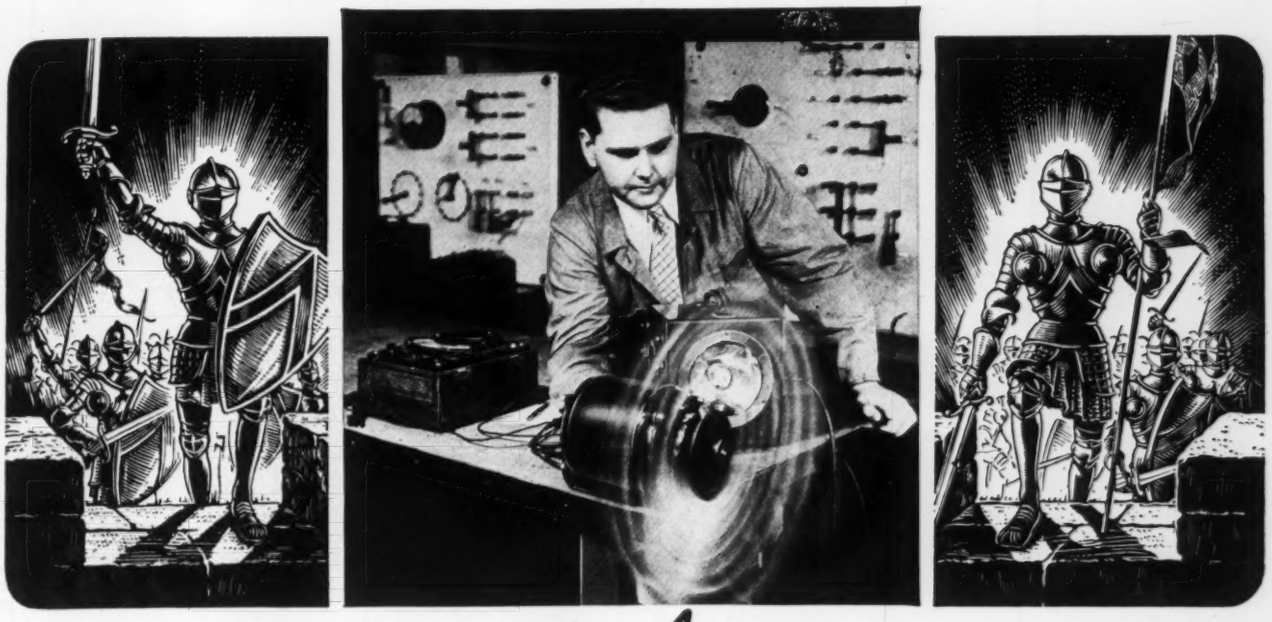
Introduces New Timing Devices

TIMING devices of the immediately recycling type have been added to the line of control equipment manufactured by Struthers Dunn Inc., 139 North Juniper street, Philadelphia. The synchronous motor of this device, shown herewith, drives cams through a chain of gears. At the time the starting impulse is received, the motor starts and a solenoid is energized to operate a clutch which connects the cams to the motor. At the end of the cycle the motor is de-energized by means of a contact on one of the cams, and the clutch holds the cams in position. When the solenoid is de-energized, the cams are returned to the starting position by means of a spring. The timing is adjustable over a wide range and practically any desired arrangement of load contacts may be furnished.



A synchron o us m o t o r driving cams through a chain of gears is used in timing device of the immediately recycling type

Another new timing device of the company is of the continuously rotating type. By means of gears the cams of the timer are made to revolve at 1 revolution per minute or any other desired speed. The contacts can be arranged to be closed for any time up to half the time required for one revolution if the timing is adjustable, or up to



Leadership

EARNED THROUGH 46 YEARS OF PIONEERING

Forty-Six years!—a long time to pace the progress of an industry. It dates back to the dawn of the commercial motor age—when the Faraday type homo-polar dynamo-electric machine gave way to Gramme's reversed dynamo, the first practicable electric motor.

Back in 1891, one year after its founding, Emerson Electric pioneered the *first* commercially successful appliance motor and later sponsored the *first* complete line of *interchangeable* fractional horsepower A. C. and D. C. power motors. Year after year, this same pioneering spirit has contributed scores of significant achievements in both the development and improvement of practically every type of power motor within the range of 3 horsepower and smaller.

Sound, fundamental policies in Engineering, Designing, and Manufacturing have been responsible for the continuous growth of Emerson Electric, a name that is known and respected the world over for consistent, progressive leadership.

Despite their established superior performance, Emerson Motors are competitively priced and quickly available in any quantity. Write for Bulletin 53-M.

STAR PERFORMERS

The Star Manufacturing Company, Inc., St. Louis, Mo., has pioneered and progressed remarkably in the development of pop-corn machines. This company produced the world's first production-built line—introduced the *first* popular priced models—built cabinet types of superlative beauty. For a half decade, Star Machines have gone into service equipped with perfectly adapted Emerson Motors (some with chromium plated finish). They have continuously given "Star" performance.

THE EMERSON ELECTRIC MFG. CO.
ST. LOUIS, MO. • *Branches:* New York • Detroit • Chicago

EMERSON ELECTRIC

MOTORS — FANS — APPLIANCES

LEADERS IN THE FAN AND MOTOR INDUSTRY SINCE 1890

THIS PART MADE OF MATERIAL "X" HAD SEVERAL DISADVANTAGES

This small gear, used to eliminate noise caused by metal to metal contact, was made formerly from a material that is relatively expensive to fabricate. Possessing *some* of the desired properties, this material fell short in several—notably it had a tendency to crystallize under vibration, wore rapidly, and was seriously affected by oils.

FABRICATED FROM WILMINGTON VULCANIZED FIBRE

IT MET EVERY SPECIFICATION!

Wilmington Fibre solved the problem!

Fabricated from this genuine vulcanized fibre, the part possessed *every* property and quality required . . . yet actually cost less to produce, because Wilmington Fibre is very easy to machine.

This case is typical of the improvement and savings that have been made on parts of all sizes and shapes for almost every conceivable purpose. If your product has a part that must provide perfect insulation against current, heat, shock, noise or vibration—and, in addition, must be made from a material of unusually broad physical properties—investigate Wilmington Fibre!

SPECIFY WILMINGTON IN THE DESIGN !

Write today concerning your specific problem . . . or, send for our 32-page treatise on fibre and fibre fabrication. No obligation.

"Wilmington Fibre"

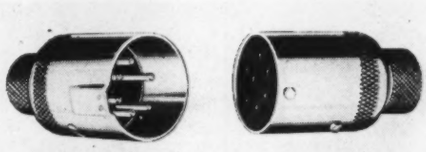
WILMINGTON FIBRE SPECIALTY COMPANY

PIONEERS IN FIBRE FABRICATION — WILMINGTON, DELAWARE

the full revolution time if the timing is not adjustable. Almost any desired number of adjustable or nonadjustable contacts can be furnished.

New Plugs Are Protected

SIX-POLE multiple circuit plugs and receptacles in a new series rated 10 amperes, 250 volts, are being introduced by Pyle-National Co., 1342 Kostner avenue, Chicago. These plugs, shown herewith, are adaptable to a variety of uses requiring multiple connections to portable equipment. Among these uses are those for all types of portable sound equipment, for instrument circuits, thermo-couples, remote control circuits and similar purposes. The new series



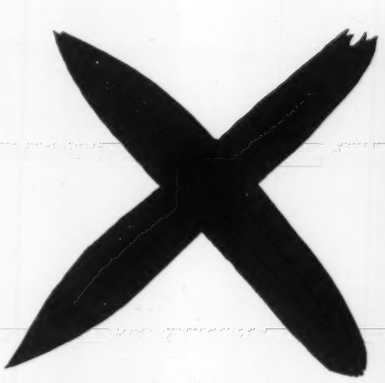
Heavy gage drawn steel, cadmium plated housings protected multiple circuit plugs

are of substantial construction, yet light in weight, compact and protected to withstand rough handling.

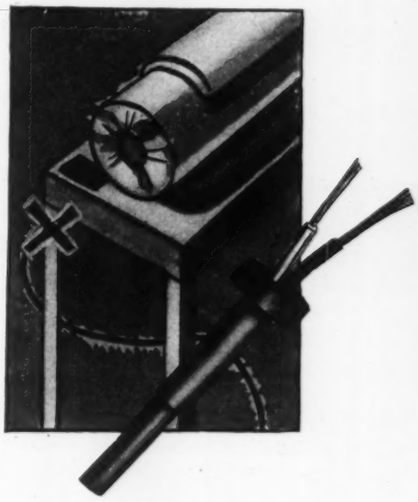
Housings of the parts are heavy gage drawn steel, cadmium plated. The contacts (especially the male contacts) are fully protected by Bakelite insulation and the housings. Plugs can be inserted in only one position, insuring correct engagement and protection of the grounding contact. Male and female contacts are self-aligning as they are arranged to float in the insulation. The bayonet locking device prevents accidental separation as a twist and a pull are required to move the plug. A rubber-packed strain relief cord clamp is provided to remove strain from the wires at the contact terminals. The cord clamp also excludes dirt and moisture from the terminal connections.

Coating Permits Selective Hardening

DEVELOPED originally by Grapho Products Inc., 2232 Alvord street. Indianapolis, to lower the cost of plating where selective hardening is necessary, the new copper plate solution Kwik-Cote is a chemical compound which deposits a copper plating on the part to be treated by dipping or painting with a small stiff brush. Hair-line separation of hardness can be



MARKS THE SPOT WHERE MANY ELECTRICAL FAILURES START



Protect the Useful Life of Your Appliances with a G-E Molded Rubber Strain Relief

X marks the spot where the cord set is connected to the appliance . . . the point at which many electrical failures start. Here is where strains are severest . . . connections torn away . . . and cord sets fail.

You can eliminate these weaknesses and resulting costly service troubles by using G-E Molded Rubber Strain Reliefs. The resilient rubber protectors are molded directly to the cord at the spot where the greatest strain and wear occurs.

General Electric Strain Relief assemblies provide a rubber bushing for anchoring the cord to the appliance housing. Thus, all dangerous strain on terminals is relieved.

The G-E Strain Reliefs, molded on the cord, are easily attached to your appliance. Once established they are neat and harmonize with your product. The appearance of your product is enhanced by their use.

Moreover, they are the only Rubber Cord Protectors molded onto the cord. Equip all of your appliances with these modern strain reliefs.

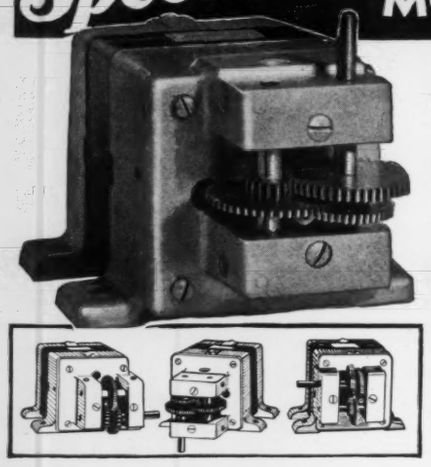
For samples and complete information, write Section Q-148, Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

ACCESSORY EQUIPMENT

APPLIANCE AND MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONN.

SpeedWay Flea Power **MOTORS**



110 V. A. C.
induction—shaded Pole

D. C. UNIVERSAL
series wound

Direct Driven or Back Geared

Cased and Skeleton Types

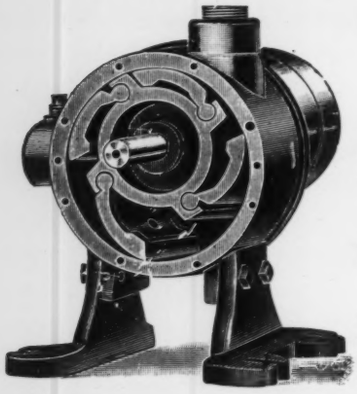
MINIATURE MOTORS—a complete line of dependable "flea-power" motors, cased, semi-cased and skeleton types for all 110 V. currents. Sturdy, cool-running motors for a 1000 different uses, with or without speed reducers. A Multi-purpose unit (as illustrated) complete with quiet worm-driven speed reducer, that can be assembled to drive up or down, right or left, to deliver any speed. Other complete Back-geared units that weigh but 10 ounces and sell as low as $1.10—in thousands. Many Types. One or a million on short notice.

WRITE FOR CIRCULAR

SPEEDWAY Manufacturing Co.
1858 S. 52nd Ave. CHICAGO, U. S. A.

THE MACHINE DESIGNERS' FAVORITE AIR PUMP

Favorite because of its numerous sizes, its simple lines of construction, but above all because of its reliability—its positive performance which—just because it is so simple in design—can never fail to give its best.



LEIMAN BROS.
Patented Rotary Positive
AIR PUMPS
for pressure, vacuum and gas pumping

They Take Up Their Own Wear

Used on all worth-while automatic machines, paper feeders, bottle fillers, oil burners, and gas appliances.

Aerating — Agitating — Singeing — Branding — Preheating — Assaying — Brazing — Annealing — Soldering — Forging —Calliopes — Milking Machines — Steam Heating Systems — Paper Feeding Devices — Printing Presses — Oil Furnaces — Gas Furnaces — Coal Furnaces — Suction Chucks — Vacuum Cleaning — Solder Iron Heaters — Wrapping Machines — Mailing Machines — Testing Gas Fittings — Removing Foul Air — Supplying Fresh Air — Melting — Hardening — Massaging Machines — Laboratory Work — Blow Lamps — Blow Pipes — Glass Blowing — Gas Pumping — Testing Meters — Pressing Irons — Vacuum Frames

LEIMAN BROS., INC.

177 (8) Christie St., Newark, N. J.
LEIMAN BROS. N. Y. CORP. 23 (P8) Walker St., New York, N. Y.
Makers of Good Machinery for 45 Years

secured with positive results. Threads treated with the solution may be kept dead soft and in perfect condition while the remainder of the piece is hardened. Only the parts to be kept soft are treated. A Scleroscope hardness variation from 80 to 30 is secured. The solution may be used between cams, back of gears, threads, in bores where stock is left for reaming after heat treating, on springs or any other section to be left soft. It may be used as a base for nickel or chrome plating.

Exactly Controls Oiler Feed

EXACTING requirements of bearings varying in size, speed and temperature are met by the new feed control feature of the drip-drop oiler, for solid, wick and waste-packed bearings, being manufactured by Trico Fuse Mfg. Co.,

Simple adjustment will prepare these new oilers for slow, medium or fast feed as the bearing may require

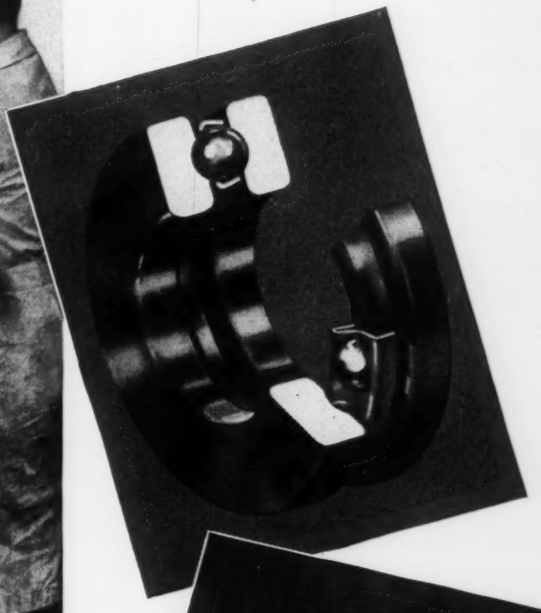
2948 North Fifth street, Milwaukee. A simple adjustment will make the oiler feed slow, medium or fast as the bearing may require. The oiler, shown herewith, is designed to fit 95 per cent of installations without drilling or tapping. It is made in three sizes.

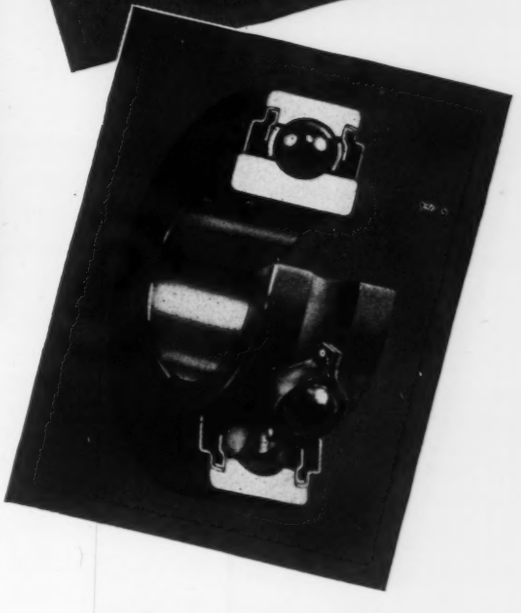
Photoelectric Control Is Sensitive

A NEW photoelectric control unit in which sensitivity and operating speed have been doubled has been introduced by Weston Electrical Instrument Corp., Newark, N. J. The unit, shown herewith, is applicable to a wide range of industrial control purposes in which interruption of a light beam conveniently provides the initial impulse for opening or closing an electrical circuit, such as counting, sorting and weighing devices, automatic processing control, safety cut-offs, alarm warnings and the like.

The assembly consists of a photocell of high output characteristics in a protective mounting, the complete relay unit in a separate panel box, as well as light source of standard design. A light intensity of 100 foot-candles falling on the cell provides adequate energy for positive opera-

The **BEARINGS**, *too, must be designed for* **ACCURACY**





"TOOL ROOM ACCURACY at production speed" calls for a high standard of manufacture in this Kearney & Trecker Vertical Milwaukee. The fact that BCA Ball Bearings are used in these milling machines, famous throughout the machine tool industry, is ample proof of BCA's ability to meet the highest requirements of accuracy and quality.

The thrust bearing illustrated is of the type being supplied by BCA to Kearney and Trecker.

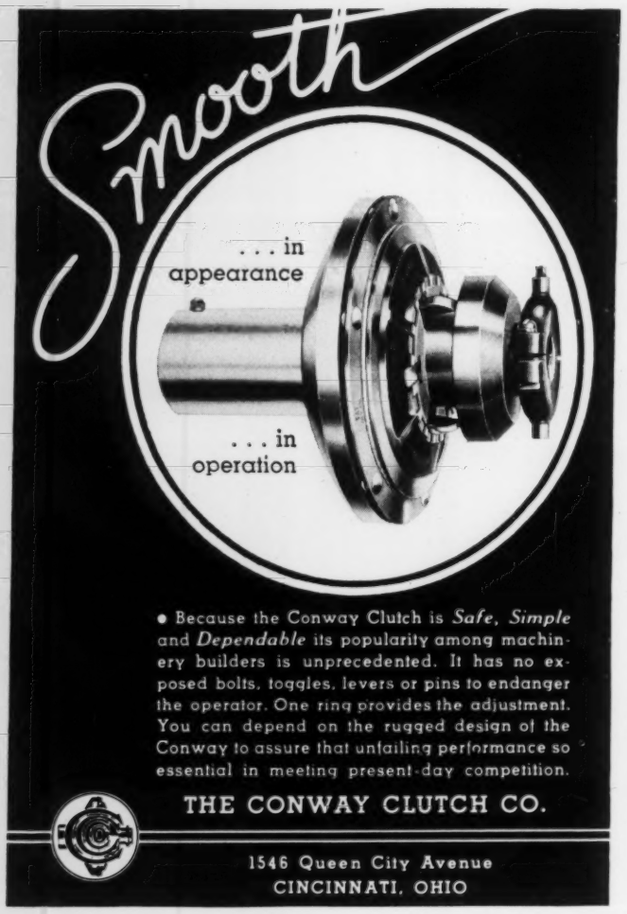
Wherever dirt and grit are a problem machine designers will do well to investigate the new BCA Radial Bearing with the composition seal, illustrated. It is certainly one of the greatest improvements in ball bearings in recent years and is probably the most efficient seal bearing made.

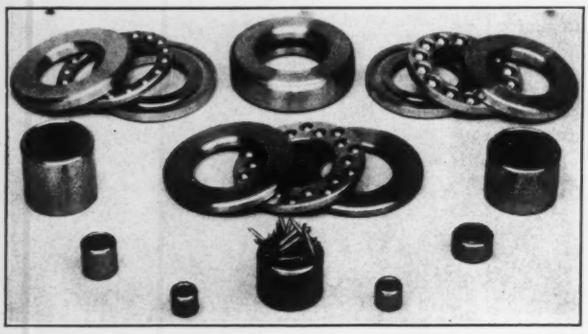
Founded nearly 40 years ago, BCA is old in experience, yet you will find our engineers young in their ideas. We suggest that you get in touch with them.

BEARINGS COMPANY OF AMERICA
517 HARRISBURG AVE., LANCASTER, PA.

BCA

RADIAL · THRUST · ANGULAR CONTACT
BALL BEARINGS


Smooth
. . . in appearance
. . . in operation
• Because the Conway Clutch is *Safe, Simple* and *Dependable* its popularity among machinery builders is unprecedented. It has no exposed bolts, toggles, levers or pins to endanger the operator. One ring provides the adjustment. You can depend on the rugged design of the Conway to assure that unfailing performance so essential in meeting present-day competition.
THE CONWAY CLUTCH CO.
1546 Queen City Avenue
CINCINNATI, OHIO



800% GREATER DEMAND

THAT'S the way industry has been flocking to Bantam for bearing requirements, whether they be Ball Thrust, Roller Thrust or Journal Rollers. An 800% increase in demand since 1932.

After all, "the proof of the pudding is in the eating," so why not try Bantam Bearings once? From then on your own good judgement will bring you back for more.

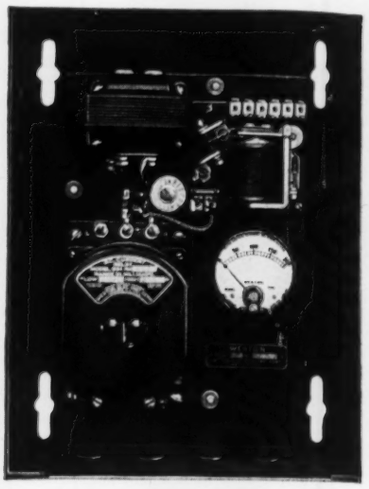
Write for NEW Catalog

Every designing engineer in the country should have a copy of this book. It shows a comprehensive picture of the bearings which are saving money for manufacturers of small and large machinery. Send for catalog No. 101 TODAY!

THE BANTAM BALL BEARING CO.
SOUTH BEND, INDIANA

BBB TAKE YOUR TOUGHEST BEARING JOB TO BANTAM

tion of the relay system in contrast to the 200 foot-candle level formerly required. Output capacity of the new relay is 500 watts, so that most installations can be handled directly by the relay contacts without the use of external contactors.



Photocell, complete relay unit and light source are combined in new electronic control for industrial uses

The relay is arranged for single-pole, double-throw operation, with an overall speed of response of 0.15 seconds. Positive action of the relay at speeds up to 400 operations per minute permits automatic control of high speed industrial processes.

Engineering Department Equipment

Increases Size of Blueprinters

ANOTHER model has been added to the line of Angstrom lamp blueprinters built by Milligan & Wright Co., 1221 West Third street, Cleveland. This unit, shown herewith, is double the size of previous models, that is 24 by 36 inches, and has been developed for work which could not be handled on the 18 by 24 inch sizes. Essential features of the older model are all retained, including the use of incandescent lamps

This blueprinter of double the size of previous models has been introduced for large work

In the
October Issue

WELDED DESIGN

is to be treated exclusively in a special section.

MACHINE DESIGN
will bring to its readers such features as:

◆

WELDING HIGHLIGHTS

—A concise and informative treatise on past, present and what is likely to be future design practice in this method of joining materials. Written by an authority of high standing in the engineering profession.

◆

DESIGNING FOR WELDING

—Covering a new machine in which welding was the uppermost consideration. Designers will gain first hand information that can readily be applied to their own problems.

◆

WHY WELD?

—Expressions from prominent chief engineers.

◆

LOW TEMPERATURE WELDING

—A glance into what's ahead.

◆

CASTINGS vs WELDING

—Always a live argument and one that now has reached a practical plane.

These and many other aspects of welding will pass in review before engineers' eyes.

◆ ◆ ◆

TO enhance its value the welding section will be so stapled in the October number as to be readily removable for filing purposes without damage to it or to the magazine. The section on welded design will be included as an addition to the regular editorial contents of the issue.

You will have in one complete booklet the views of design experts who have specified both gas and electric welding, and the metals used therein. Advertising pages created specifically for the welding section will form a fitting supplement.

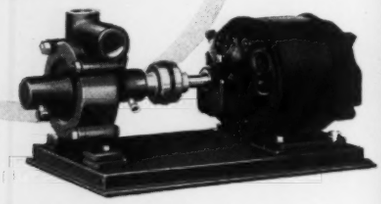
Watch for this Guide to WELDED DESIGN ◆

MACHINE DESIGN

PARTS • MATERIALS • METHODS • FINISHES

Penton Building - - - - Cleveland, Ohio

Use
TYPE "T"
PUMPS
for small volumes
at high heads



Capacities from 5 to 200 GPM at heads up to 500 ft. Economical in operation at variable heads. Power consumption reduced as head is lowered. High suction lift—will not vapor lock—one moving part. Standard bronze fitted, all bronze, or all iron. Write for Bulletin 260-B11A.

"Tomorrow's Engineering Approved by Yesterday's Experience"

Roots
CONNERSVILLE
BLOWER CORP.
CONNERSVILLE, INDIANA

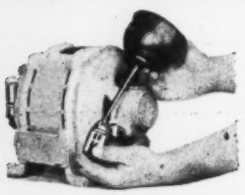
CONSTANT
OIL LEVEL
Always

. . . and reliable too

Gits Constant Level Oilers will at all times maintain a correct oil level in motor bearing reservoirs, that will never permit oil to rise higher than the proper level, eliminating any chance of flooding the bearings or motor windings.

Send for specially prepared catalog.

Exclusive Feature— unbreakable bottle hinges to cup. No danger of spilling. Bottle returns in upright position without loss of oil.

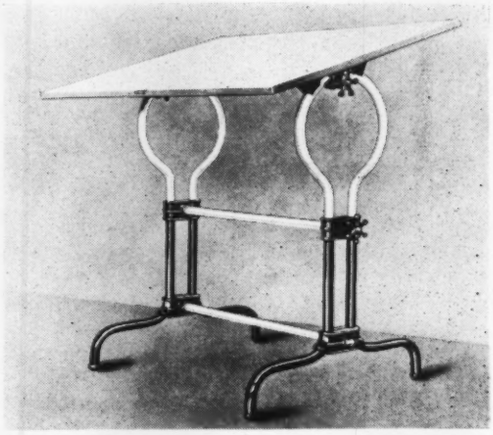


GITS BROS
MANUFACTURING CO.
1861 S. KILBOURN AVE., CHICAGO

as a light source and the elimination of the belt feed by the flat bed printing surface. A timing switch of the heavy duty type has been developed for automatically breaking the heavier current and forced ventilation is supplied to prevent any tendency to overheat.

Drawing Table Is Fully Adjustable

FULL adjustability features the new drawing table introduced by Drafto Co., Cochranton, Pa. The board of the table, shown herewith, is clamped to circular chrome plated loops that telescope into legs of the steel-tubing frame. Table height can be adjusted quickly from 32 to 40 inches. The table can be tilted from horizontal to vertical on either side of the base. Cross-rods, spacers and clamps are all machined to fit. Specially selected steel tubing is used in the supporting structure. The board is first-quality wood, true and smoothly finished. Sturdy metal clamps unite the assembled table into a rigid unit.



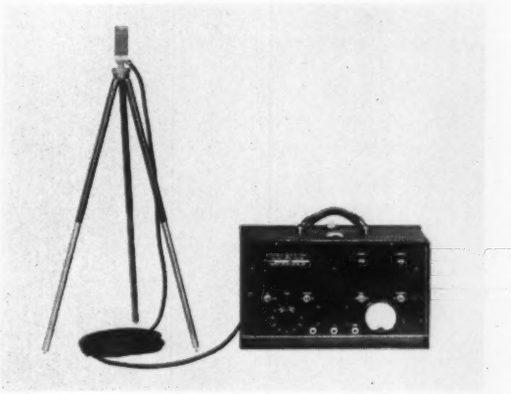
Drawing table is designed to give complete adjustability to either side

Loops and cross-rods of the table are chromium plated while clamps, brackets and legs are finished in black baked enamel. The standard table as shown has a 23 by 31 inch board and a lengthwise foot spread of 24 inches. It weighs 30 pounds.

Meter Eliminates Personal Element

A NEW sound-level meter which will give a quantitative measure of noise independent of the personal element, and at the same time give results commensurate with the sensations

experienced by the ear, has been announced by General Electric Co., Schenectady, N. Y. The meter, shown herewith, was developed to provide performance in accord with the newly adopted American Standards association standards. Special precautions have been taken to make the amplifier unit of the instrument suitable for use in the neighborhood of electrical



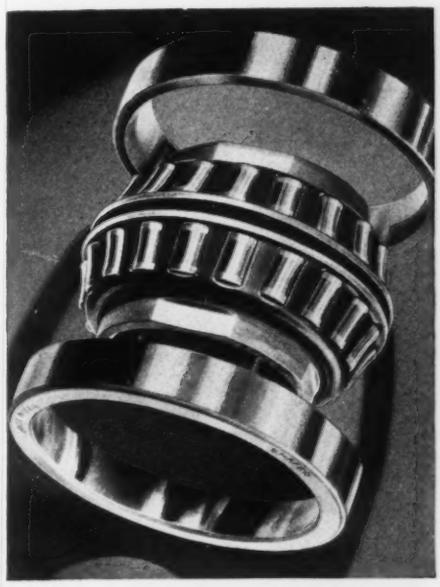
A quantitative measure of noise independent of the personal element is given by noise meter

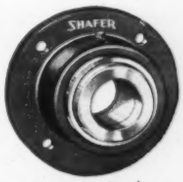
machinery where stray magnetic fields are common. The complete instrument, including microphone, tripod, calibrating unit and batteries is contained in a compact metal case 15¾ by 9½ by 8¼ inches.

The microphone is a small, nondirective, piezo electric type with practically flat frequency response up to 8000 cycles per second. It is shielded against stray electric fields, and is not affected by stray magnetic fields such as those usually surrounding electrical machinery.

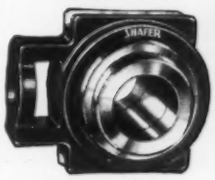
Employs Glass Fibers for Erasing

HUNDREDS of spun glass fibers treated with a special flexible binding solution compose the Rush-Eraser introduced by Eraser Co. Inc., 120 East Washington street, Syracuse, N. Y. These fibers are stiff enough to polish metal, yet sufficiently flexible to remove India ink from tracing cloth or ink and typewriting from bond or ledger paper. Light strokes removes fine, dust-like particles leaving a smooth surface. The fibers are contained in a holder which fits the hand conveniently, being about the size and weight of a small fountain pen. The top section of the holder turns to propel the brush through the tip. In this manner a clean, compact erasing brush can be fed through as needed until used up. The lower half of the holder unscrews to permit the insertion of a new refill. The tip of the brush is about the same size as the end of the red erasers ordinarily used in drafting work.





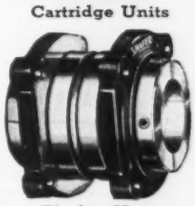
Flange Units



Take-up Units

Hanger Boxes

Cartridge Units


Duplex Units

Pillow Blocks

EVERYTHING YOU NEED . . . . . in a ROLLER BEARING UNIT

The exclusive design of the Shafer Bearing combines every essential performance feature. Shafer Pillow Blocks and other compact roller bearing units are therefore adapted to the widest range of industrial uses.

Only Shafer Bearings combine 1. radial-thrust capacity, 2. integral self-alignment, 3. simple adjustability. Every Shafer Roller Bearing unit provides security against mis-alignment, shock loads, shaft deflection, or inaccuracies of mounting.

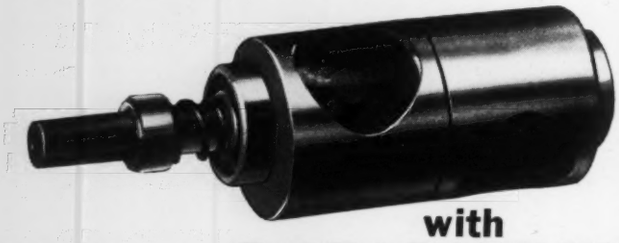
Investigate the extra value and extra performance delivered by Shafer Roller Bearing units.

SHAFER BEARING CORPORATION
6513 W. Grand Ave., Chicago, Illinois

Available in a very complete range of types and sizes—Pillow Blocks, Cartridge Units, Hanger Boxes, Take-up Units, Duplex Units, Flange Units, Conveyor Rolls. Write for catalog 12-A.

SHAFER
SELF-ALIGNING ROLLER BEARINGS

A MULTITUDE of APPLICATIONS

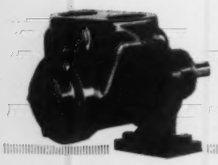


with

ROTAPISTON

The reciprocating cylinders at right angles to one another — each double acting—afford continuous flow.

- ¶ Pumping paint pigments to paint grinding machines.
- ¶ Circulating enamel in enamel dipping vats.
- ¶ Circulating quenching oil thru cooling coils.
- ¶ Circulating 600-W lubricant in large speed reducers.
- ¶ Circulating soluble oil coolant on machine tools



3 Standard Sizes, interchangeable with other makes of pumps. 4 other models with special mountings available. Capacities from ⅛ to 324 gallons per minute. *Write for folder.*

THE GLOBE PRODUCTS CO.

4008 E. 89th St. Cleveland, Ohio

Write for it . . .

● YOUR SAMPLE FILE of the standard types of felt—bound into a chart classifying applications of each type! Designed to be useful to all users of felt—not for sales follow-up. Mailed without charge.

Booth
PRECISION CUT FELT

BOOTH FELT COMPANY, INC. 444—19TH ST., BROOKLYN, N. Y.

MEETINGS *and* EXPOSITIONS

Aug. 30-Sept. 3—

Leipzig Trade Fair. The 1976th session of this fair is to be held at Leipzig, Germany. Information may be obtained from Leipzig Trade Fair Inc., 10 East Fortieth street, New York.

Aug. 31-Sept. 4—

National Association of Power Engineers. Annual meeting to be held at Stevens hotel, Chicago, will include an exhibition of equipment. F. W. Raven, 176 Adams street, Chicago, is secretary.

Sept. 7-11—

American Chemical society. Semi-annual meeting to be held at Pittsburgh. Charles L. Parsons, 728 Mills building, Washington, is secretary.

Sept. 7-12—

World Power Conference. Third conference is to be held at Washington. M. T. Waters, Interior building, Washington, is assistant to the director.

Sept. 8-10—

American Gear Manufacturers association. Semiannual meeting to be held aboard S. S. SEEANDBEE, sailing from Chicago and docking at Cleveland. J. C. McQuiston, Penn Lincoln hotel, Wilkinsburg, Pa., is secretary.

Sept. 22-25—

Association of Iron and Steel Engineers. Exposition and thirty-second annual meeting to be held at Convention hall, Detroit. Brandt Wiley, 1010 Empire building, Pittsburgh, is secretary.

Sept. 28-Oct. 3—

American Bakers association. Exposition of equipment to be held at the Auditorium, Atlantic City, N. J. Tom Smith, 1135 Fullerton avenue, Chicago, is secretary.

Oct. 5-10—

Industrial Materials exhibit. Fourth annual exposition to be held at Hotel Roosevelt, New York. Information may be obtained from Don Masson, 247 Park avenue, New York.

Oct. 12-17—

Dairy and Ice Cream Machinery and Supplies association. Annual exposition to be held at the Auditorium, Atlantic

City, N. J. Charles W. Caldwell, 232 Madison avenue, New York, is assistant treasurer.

Oct. 15-17—

Society of Automotive Engineers. National Aircraft Production meeting to be held at Ambassador hotel, Los Angeles. John A. C. Warner, 29 West Thirty-ninth street, New York, is secretary.

Oct. 19-23—

American Society of Metals. Annual meeting to be held at Cleveland. W. H. Eisenman, 7016 Euclid avenue, Cleveland, is secretary.

Oct. 19-23—

American Welding society. Annual meeting to be held at Hotel Cleveland, Cleveland. M. M. Kelly, 33 West Thirty-ninth street, New York, is secretary.

Oct. 19-24—

National Business Show. Exhibition of office machinery and equipment to be held at Commerce Hall, Port Authority building. New York. Frank E. Tupper, 50 Church street, New York, is in charge.

Consider the Cord Set as Vital Part

(*Concluded from Page* 32)

assembly to insure waterproof and strain proof connection between the two cords.

In cases where other considerations outweigh the foregoing advantages of detachable cord sets, special attention should be given to protection of the permanently attached cord at the appliance end. Two methods are illustrated in *Fig.* 5, one being on a vacuum cleaner, the other on a radio receiver. Molded-on strain relief sleeves are recommended particularly on appliances whose normal operation involves a great amount of flexing of the cord as is the case with a vacuum cleaner.

An example of how modern styling can be extended from the appliance on into the cord set is furnished by the dry shaver assembly shown in *Fig.* 4. On account of the small size of this device and the small amount of power required for its operation, it is possible here to use a special molded-on connector of unusually small size. The other example shown in *Fig.* 4 is a connector body recently designed for use with a comptometer, this also being of molded-on type. While a considerable range of color is possible both in rubber and braided cords, gaudy and conspicuous cord sets had best be avoided. Black is by far the most popular and serviceable color, although brown, gray and green are being used effectively on certain applications.

DESIGN ON PARADE

Through the centuries design has moved forward. Often hated, frequently fought, design progress could not be stopped.

Today the tempo has quickened. The parade doesn't wait for laggards!

This parade is pictured in the pages of *Machine Design.* Every article is a record of progress from which the design engineer can adapt ideas to his own problems.

From the more than 6200 manufacturers of machines, from the thousands of makers of parts, materials and process equipment, from practicing engineers and the laboratory, the latest developments are brought to your attention.

Short, pertinent design topics are covered each month under the heading "Scanning the Field for Ideas."

Watch for these developments!

SAVE! on SPECIAL PUMPS

. . . by telling **YOUR** requirements to **US.**

Often, from our extensive line, we can adapt **STOCK PARTS** for the users benefit.

What are your pump needs?

Brown & Sharpe Mfg. Co.
Providence, R. I.

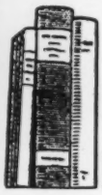
BROWN & SHARPE PUMPS

B·S

THE SAME LAMINUM SHIM that saves precision machining, fitting, and factory assembly costs, gives users an easy, accurate service adjustment feature for the life of the equipment. You simply peel your adjustments . . . one or more laminations at a time . . . from the solid laminated shim! Write for a sample of LAMINUM . . . either .002 or .003" laminations.

LAMINUM
Precision adjustment **SHIMS**

LAMINATED SHIM CO., 21-18 44TH AVE., LONG ISLAND CITY, N.Y.



MANUFACTURERS' PUBLICATIONS

ALLOYS (COPPER)—Ampco metal alloys including bronze, aluminum bronze and beryllium-copper are comprehensively discussed in catalog No. 21 of Ampco Metal Inc., Milwaukee. The booklet gives complete details and physical properties of each of the alloys and presents applications including bushings, gears, machine parts, worm wheels, cams, forming dies, slides, cams, rollers, acid equipment, etc.

ALLOYS (STEEL)—Duraloy Co., Pittsburgh, has prepared a bulletin on its line of chrome-iron, chrome-nickel and nickel-chrome alloys for resisting temperature, corrosion and abrasion. Details on each of the alloys, the type of use for which the alloy is recommended and typical applications of each are given. A table in the bulletin gives the characteristics of the various alloys including data on machinability, weldabilty, heat treatment, and similar points of interest to the designer.

ALUMINUM—Aluminum Co. of America, Gulf building, Pittsburgh, is distributing a booklet on the use of aluminum alloys for truck body construction. Details are given on sheet and plate, extruded shapes and molding, and standard structural shapes.

BASES—Vibration isolation by means of steel springs is the subject of a new bulletin brought out by Korfund Co. Inc., 48-15 Thirty-second place, Long Island City, N. Y. The bulletin gives complete treatment of the isolation of machinery.

BEARINGS—Ahlberg Bearing Co., 321 East Twenty-ninth street, Chicago, has issued a new loose-leaf catalog containing complete engineering specifications on its new pillow block and other mounted ball bearings. The booklet also contains complete data on the company's line of ball bearings.

BLOWERS—Roots-Connersville Blower Corp., Connersville, Ind., has prepared bulletin 21-B18 which is devoted to the application of blowers in raw water ice plant service. Complete details on the blowers and typical applications are given.

CONTROLS (ELECTRICAL) — An auto-transformer consisting of a single winding on a toroidally-shaped core as used for voltage control is presented in a folder of General Radio Co., 30 State street, Cambridge, Mass.

DRIVES—How belting is tested by modern research

methods and the results of these investigations are included in a complete 32-page bulletin recently published by E. F. Houghton & Co., 240 West Somerset street, Philadelphia.

DRIVES—Engineering data on straight line drive spur gear speed reducers in ratios up to 20 to 1 are given in bulletin 1200 of Abart Gear & Machine Co., 4836 West Sixteenth street, Cicero, Ill. The bulletin also includes useful tables of horsepower rating at input RPM.

DRIVES—A concise reference book on silent chain drives is being distributed by Ramsey Chain Co. Inc., Albany, N. Y., as catalog 636. This data book gives details of the various chain designs, instances of application, and engineering information that will enable the specification of the chains for specific uses.

DRIVES—Falk Corp., Milwaukee, has just issued two new bulletins on its line of herringbone and right-angle speed reducers. The new 56-page bulletin on the herringbone types describes in detail parallel shaft speed reducers (with both sleeve and roller bearings) rated according to the recommended practice of the AGMA. Bulletin 2100 is a 60-page publication describing in detail right-angle speed reducers, both horizontal and vertical types, also rated according to AGMA recommendations. Complete directions for selecting a standard unit are included.

ECONOMICS—A proposed method to get people back to work and to make agriculture profitable is given in a new leaflet of Century Electric Co., 1806 Pine street, St. Louis, entitled "Prosperity Through Consistent Prices versus Chaos Through the New Deal." E. S. Pillsbury, president of the company, is the author of the bulletin.

FASTENINGS—Standard and special washers as produced by Wrought Washer Mfg. Co., 2212 South Bay street, Milwaukee, are completely presented in stock list No. 55-A of the company. The list gives the dimensions of the washers, materials used, and their characteristics.

FORGINGS—Data helpful in the preparation of drawings for drop-forged parts is included in a new file folder prepared by J. H. Williams & Co., Buffalo, N. Y.

INSTRUMENTS—A recently issued 16-page catalog of C. J. Tagliabue Mfg. Co., Park and Nostrand avenues, Brooklyn, N. Y., details the features of the company's indicating, recording and controlling pyrometers which utilize a beam of light, a mirror galvanometer and a phototube.

LUBRICATION AND LUBRICATING EQUIPMENT—Bowen Products Corp., 2760 Warren avenue, W., Detroit, has prepared catalog No. 9 which gives complete details on its line of grease cups, oil cups and lubricating devices of all types. Typical stampings and screw machine work as done by the company are illustrated in the booklet.

MOTORS—An engineering service blank designed to aid in quickly solving universal motor problems has been prepared by Dumore Co., Racine, Wis.

PACKING GLANDS AND PACKING — Crane Packing

☆ Ideal

Type "EC" Electric Counter

for

REMOTE-CONTROL COUNTING . . Type "EC" Electric Counters are precision instruments built to operate with unvarying accuracy at speeds up to 25,000 counts per hour. The contacting switches, or photo-electric cell can be located at the point of production, on machines, conveyors, etc., and the electric counters in the office, or wherever most convenient for maintaining the record. Duplicate counters can be used, one on the machine, another in the office.

Hundreds of different kinds of counting jobs are being satisfactorily handled by Production Instrument counters and switches, often under operating conditions that prevent the use of ordinary counting equipment.

Type ES-1 Single Contact Switch—one of many types available

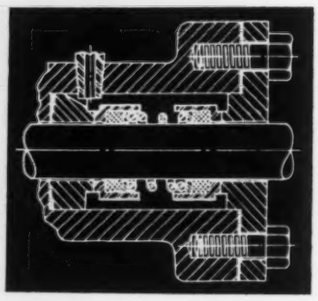
Write for bulletins describing Type "EC" Electric Counters, and special contacting switches.

PRODUCTION INSTRUMENT COMPANY

1319 South Wabash Ave., Chicago, Ill.

Accurate Counting and Recording Devices

Another Typical Rotary Seal Application



This Rotary Seal arrangement is the one used in many makes of large refrigeration compressors and in rotary pumps of various kinds.

ROTATES WITH THE SHAFT

Write for new bulletin giving general information on the construction, operation and application of Rotary Seals.

ROTARY SEAL COMPANY
GENERAL OFFICES
803 West Madison St. Chicago, Ill.

Consider the Itemized Index!

All drive developments in this issue are listed on page 7.

Every reference to materials as used in machinery can be located through page 7.

Individual design problems are classified for maximum utility, on page 7.

In every issue of MACHINE DESIGN the problems, parts, materials, mechanisms, in short, every detail covered by that issue is carefully *Itemized.*

Increasing reference is being made to the Itemized Index by alert engineers as a regular part of their design procedure.

SEE PAGE 7!

Co., 1813A Cuyler avenue, Chicago, has prepared a folder on its new product, an antifrictional plastic packing. This product is a general all-service packing with a new antifrictional dry-graphite lubrication.

SHAPES—How cold drawing often eliminates costly production methods is brought out in a new folder of Union Drawn Steel Co., Massillon, O. Another interesting folder of the company discusses cold drawn alloy steels and their effect on the cost of alloy steel parts. Parts machined from cold drawn shapes are illustrated in the booklet as made from nickel steels, chromium steel, nickel-molybdenum steel, chromium-vanadium steel and nickel-chromium steels.

SPRINGS—For the convenience of spring users and designers, Wallace Barnes Co., Bristol, Conn., has just published an excellent handy reference book of spring information. When possible, design information has been conveniently charted to facilitate use; in all instances, formulas are given for obtaining correct specifications for springs under individual conditions of use. A complete table of physical properties of spring materials will also prove helpful in the selection of the right spring for the purpose. Specific examples of the various types of springs in everyday use are included, as well as special springs for unusual uses.

WELDED PARTS AND EQUIPMENT—Lincoln Electric Co., Cleveland, has prepared a bulletin which illustrates how lower piping costs may be attained with shielded arc welding.

WELDED PARTS AND EQUIPMENT—Lukenweld Inc., Coatesville, Pa., is distributing a booklet which gives complete details on the design and construction of welded steel truck frames for subway-elevated multi-section cars, to be used in the New York transportation system, replacing former designs.

Research Publications

Organic Plastics. The modern plastics industry deals chiefly with moldable materials manufactured from organic compounds. Synthetic resins, natural resins, cellulose derivatives and protein substances are the four principal types of these organic plastics. In order to meet a growing demand for information on these materials, this bulletin has been prepared on the subject. The various organic plastics are discussed from the standpoint of the raw materials required, the chemical reactions involved, the various methods of processing, and the more important applications. The synthetic resins are subdivided into several chemical types as follows: Phenolic-aldehydic, amino-aldehydic, vinyl, hydroxy-carboxylic, indene, organic-polysulphides and miscellaneous. Natural resins of animal, vegetable and mineral sources are described. The chemistry of the cellulose esters and others and cellulose xanthate is outlined. Protein plastics considered include those prepared from casein (milk), blood albumin and soy beans. Published as bureau

circular C411 by National Bureau of Standards. Available from Superintendent of Documents, Government Printing Office, Washington. 5 cents.

Determination of the Brinell Number of Metals. With the increased use of the brinell test it has become important to reduce to a minimum the variations in determinations of the brinell numbers of a given metal as measured by different observers at different locations. An extensive literature has grown up which treats of the effect of the value of the brinell numbers of different variables entering into the test. In this publication there are brought together some of the results of such investigations and these have been supplemented by results of new tests and new analyses wherever the existing data seemed deficient. Discrepancies due to variations in test procedure, in the method of indenting, and variations in the type of ball used are considered at length. The conclusions of this review of old and new data on brinell tests are summarized in recommendations for a test procedure designed to lead to greater concordance in the brinell numbers obtained by different observers testing a specimen of given material. Published by National Bureau of Standards as RP903. Available from the Superintendent of Documents, Government Printing Office, Washington.

The Effect of Overstrain on Closely Coiled Helical Springs and the Variation of the Number of Active Coils with Load. by D. H. Pletta, S. C. Smith and N. W. Harrison. This paper presents the results of a series of tests conducted to determine the effect of overstrain beyond the elastic limit of closely coiled helical springs, and the variation of the number of active coils with the load on the spring. These tests indicate that the overstrain of cold-working usually imparted to springs in the bull-dozing operation of their manufacture will cause a decrease of several per cent in the load-deflection rate of the spring, with only partial recovery during a rest period of about two months and no further noticeable recovery in a year. The cold-working is also likely to increase the tendency of the ends to seat progressively as subsequent loads are applied to a spring, thus affecting the number of coils active at any given load. Published as engineering experiment station series bulletin No. 24, by Virginia Polytechnic institute., Blacksburg, Va. 30 pp.

Thermal Expansion of Copper-Beryllium Alloys. The expansion curves of quenched copper-beryllium alloys containing 1.33 and 2.14 per cent of beryllium showed under test critical regions which may be associated with structural changes accompanying aging. Stabilization of the alloys may be accomplished either by tempering or by cold working. There is no simple relation between the coefficients of expansion, chemical composition and heat treatment of the copper-beryllium alloys investigated. The coefficients of expansion of the alloys do not differ from the corresponding value for copper by more than 8 per cent of the latter value, whereas differences for the hardness, tensile strength, elongation and reduction of area are considerably greater. Changes in length, density and volume noted for both the quenched and the hard-drawn alloys are somewhat larger than the small changes noted for the aged alloys. Density of copper-beryllium alloys decreases with increase of beryllium. Published by National Bureau of Standards as RP 890. Available through Superintendant of Documents, Washington.

CONSTANT IMPROVEMENT
by WAGNER
has resulted in
Quieter Polyphase Motors

SINCE 1891, Wagner has manufactured polyphase motors. During these years, Wagner has continuously improved these motors to meet the many varied and exacting requirements of modern industry. Today, Wagner motors embody the latest improvements in motor design and manufacture. Among the outstanding features of Wagner motors are: *(1)* QUIET OPERATION, *(2)* special operating characteristics to meet exacting service, *(3)* long life, and *(4)* attractive appearance.

A few of the points of superiority of Wagner squirrel-cage motors are:

1. Rotor is of the cast-aluminum type, with bars, end-rings and blowers cast integrally, effecting a one-piece rotor exceptionally sturdy and long-lived. Skewed closed rotor slots minimize magnetic pulsations across the air gap and produce uniform starting torque at different positions of the rotor.

2. The frame and end-plates are strong and rigid, and accurately machined—assuring permanent alignment of bearings and uniform air gap, two essentials for quiet operation.

3. Blowers furnished on both ends of the rotor and many large openings in the stator frame insure thoro and unrestricted ventilation.

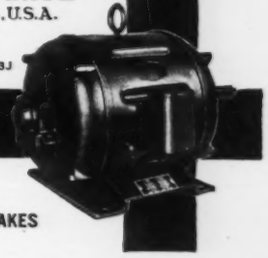
4. Stator windings are given a superior winding treatment which provides an insulating surface that is oil and moisture resisting and can be easily cleaned.

5. Stator and rotor laminations are punched from annealed, non-aging, high-grade electric sheet-steel selected for its magnetic properties.

Many other features of Wagner motors are worth investigating. Write today for Bulletin 174 which describes Wagner polyphase motors.

Wagner Electric Corporation
6400 Plymouth Avenue. Saint Louis, U.S.A.

ML 236-3J



MOTORS • TRANSFORMERS • FANS • BRAKES

Business and Sales Briefs . . . . . .

LINCOLN ELECTRIC CO., Cleveland, has appointed Industrial Supply Co., as its distributor at Salt Lake City, Utah. This company will maintain a complete supply of Lincoln products including various sizes and models of motors, electrodes and welding machinery. The Industrial company is headed by Rudolph Orlob, president, while A. B. Kemp is manager of the welding division.

* * *

Lester F. Blough has been elected vice president in charge of motor sales for Emerson Electric Mfg. Co., St. Louis, succeeding Milton C. Miller, resigned.

* * *

James E. Nyhan, 1710 Ravenwood avenue, Dayton, O., has been appointed as sales representative in Ohio for the products of La Salle Steel Co., Palmolive building, Chicago, including steel bars and shafting.

* * *

T. G. Baer has been appointed as manager of the Buffalo office of Timken Roller Bearing Co., Canton, O. Mr. Baer has been specializing on industrial sales in the Chicago office of the company.

* * *

The corporate name of Magnetic Mfg. Co., Milwaukee, has been changed to Stearns Magnetic Mfg. Co. This change does not involve any revision in corporate structure, management or plant location. It simply identifies the company and the equipment manufactured with the trademark name "Stearns". The former name will be retained in a subsidiary capacity until the new name has been definitely established among the trade.

* * *

Crucible Steel Co. of America Inc., Pittsburgh, has moved its Cambridge, Mass., office to 135 Binney street. W. P. Knecht is manager.

* * *

W. J. Hermes with offices at 100 Varick Street, New York, is now representing Dumore Co., manufacturer of universal motors, etc., in the Metropolitan New York area.

* * *

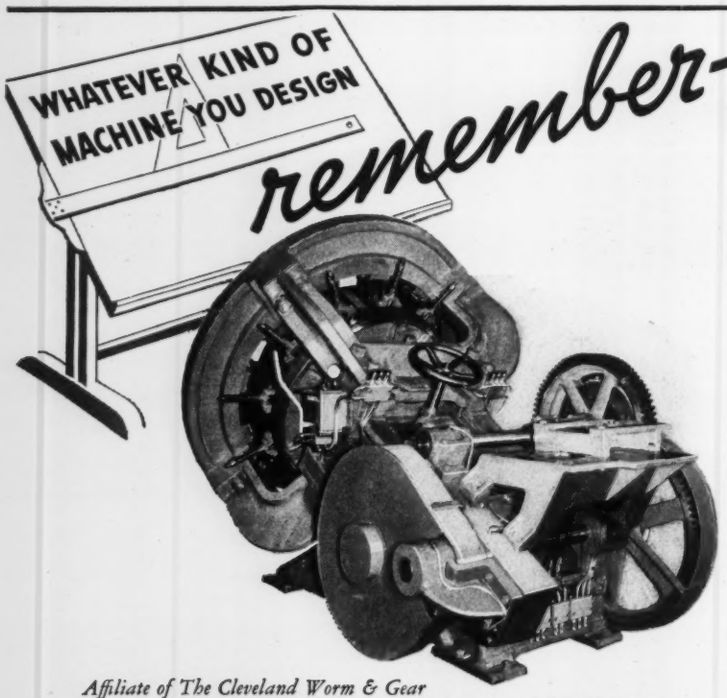
Inland Steel Co., Chicago, has established a Chicago district sales office with Leon C. Reed as district sales manager and Otto G. Neumann as assistant district sales manager.

* * *

Superior Steel Corp., Pittsburgh, has appointed Brace-Mueller & Huntley Inc. as sales representative for New York state, (excluding metropolitan New York), and northern Pennsylvania, with offices at Buffalo, Rochester and Syracuse, N. Y.

* * *

Taylor-Parker Co. Inc., Water street and Commercial place, Norfolk, Va., has been named distributor of tubular products manufactured by Republic Steel Corp., Cleveland. Chas. Millar & Son Co., Utica, N. Y., has been added to



Affiliate of The Cleveland Worm & Gear Company, Manufacturers of Automotive and Industrial Worm Gearing

FARVAL

CENTRALIZED SYSTEMS OF LUBRICATION

HAND LUBRICATION MAY PENALIZE THE PERFORMANCE OF YOUR PRODUCT

• By installing Farval Systems you will provide correct lubrication for all bearings, and prolong the production years of your equipment.

Further, Farval-equipped machines turn out more work with less spoilage and with lower consumption of power than is possible with manual lubrication.

The Farval Centralized System of Lubrication is a mechanical method of delivering clean lubricant from a central station under high pressure to a group of bearings, in exact, measured quantities. Operation is constant and positive, regardless of the number of bearings in the system, *and not a bearing is missed.*

Design Engineers are invited to write for complete information and technical data. The Farval Corporation, 3265 East 80th Street, Cleveland, Ohio.

Special Delivery to Every Bearing

the list of Enduro stainless steel distributors of the Republic company. Another addition to the list of distributors of this product is Conner Mfg. Co., Louisville, Ky. Boetticher-Kellogg Co., Evansville, Ind., has been appointed a jobber of Republic's complete line of tubular products.

* * *

Due to the necessity for expanding the production facilities of its Springfield, Mass., works in merchandising lines, particularly refrigeration and air conditioning units, Westinghouse Electric & Mfg. Co., will transfer the manufacture of small motors from its Springfield plant to Lima, O.

* * *

C. Q. Swenson has been appointed Michigan representative for Michiana Products Corp., Michigan City, Ind., makers of stainless and heat-resistant alloy steel castings. Mr. Swenson will maintain offices at 2842 Grand boulevard, Detroit.

* * *

Wallace W. Smith has been appointed as assistant vice president in charge of the sale of structural shapes, plates, floor plates and steel sheet piling by Inland Steel Co., Chicago. Milcor Steel Co., Milwaukee, has become a completely-owned subsidiary of the Inland company, following the purchase of all of the outstanding stock of the Milcor company. No changes will be made in management or operations.

* * *

Emerson Electric Mfg. Co., St. Louis, is soon to move its general offices to the southeast corner of Nineteenth and Washington avenues where the company has leased approximately 34,000 square feet of floor space. The space now devoted to office use will be absorbed by the manufacturing department. To provide additional space for manufacturing operations, the Emerson company recently leased approximately 43,000 square feet of floor space for warehouse purposes at Chouteau and Theresa avenues in St. Louis.

* * *

Kingston-Conley Electric Co., manufacturer of motors, has been moved to 68 Brook avenue, North Plainfield, N. J. This move was made primarily for the purpose of gaining additional manufacturing facilities.

* * *

R. G. and T. C. Moeller have established the Rawlplug Detroit Co., Detroit, to handle all the products of Rawlplug Co. Inc., with main plant and general offices in New York. The company manufactures a line of anchoring devices for all types of materials and a device for locking and concealing bolt, rivet and screw heads.

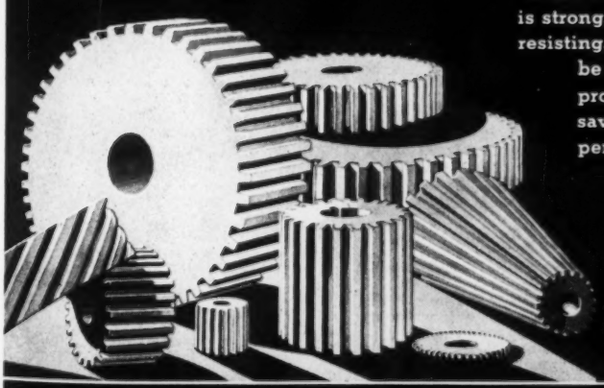
* * *

Frank C. Miller, formerly associated with the Detroit sales office, has been appointed manager of sales, tin plate division, of Republic Steel Corp., Cleveland, succeeding George E. Totten, resigned. P. H. Hubbard has been named assistant manager, as has J. B. DeWolf, formerly district sales manager of the Philadelphia territory. Further alignments in the division include the appointment, as field man, of W. H. Ungashick, formerly associated with Canton Tin Plate Co. which was recently acquired by Republic.

Include INSUROK

in your product to reduce manufacturing costs . . . to improve appearance and performance

NO other material introduced in the past decade gives greater opportunity to the designer, engineer and artist than INSUROK, the superior laminated or molded phenolic that lends itself to a thousand diversified uses.



Of known physical, chemical and electrical characteristics, INSUROK is strong, light in weight for its strength, non-corrosive, rust-proof, acid-resisting, vermin-proof, moisture-proof, heat-resisting. INSUROK can be machined readily or molded to precise intricate forms. In production equipment INSUROK gears and bearings effect sharp savings through reduced power consumption and vastly improved performance.

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Richardson, largest manufacturer devoted exclusively to the plastic arts, urges manufacturers to avail themselves of the facilities of the Richardson Design, Engineering and Research Laboratories. This service, of course, without obligation.

The RICHARDSON COMPANY

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